DIVIDEND POLICY, STOCK LIQUIDITY AND STOCK PRICE INFORMATIVENESS

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Abstract

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Dividend policy, its determinants, and its impact on firm value are of significant academic interest, and many theories and explanations have been posited on the subject over the years, but there has not been a universal agreement. This thesis examines the links between dividend policy, various aspects of stock liquidity and price informativeness. We study a sample of UK firms over the period from 1996–2013. We show that, on average, stocks of dividend payers have significantly lower bid–ask spread and a lower illiquidity ratio than their counterparts of non-dividend payers. We also find that stocks of high-dividend payers are more liquid than those of firms that pay low or no dividends. These findings are consistent with the predictions of asymmetric information that posit that paying dividends reveals inside information to the market and hence decreases the level of asymmetric information, leading to higher stock liquidity. In the subsequent analysis, we suggest and examine a new channel through which dividend policy can impact firm value. Specifically, we show that dividend payers are less exposed to shocks in the aggregate market liquidity than non-dividend payers. Similarly, we find that the systematic liquidity risk is negatively associated with amount of dividends. Finally, in the context of signalling and agency costs models, we show that dividends are negatively related to stock price informativeness and that this relationship is stronger for firms with lower stock liquidity. The findings imply that dividend policy can both affect and be affected by stock markets.

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Dedication

TO MY GORGEOUS FAMILY

This thesis is dedicated to the memory of my brother "*Ali"* and to my mother for her loving support. It is also dedicated to my husband, for his everlasting love and encouragement and my sweet daughter "*Ruqaya*", for always making me cheerful; so they know although I was far away from them and so busy for so long, there was a good reason, it was for tem as well, not just me.

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Chapter 1: Introduction

1.1. Rationale of thesis

Stock liquidity plays a crucial role in many finance areas. Many studies have examined the importance of liquidity to the different financial market players, including regulators who consider stock liquidity as one of the key determinants of any market's financial stability. Stock liquidity facilitates the flow of funds between capital suppliers and demanders, resulting in higher trading activity, and therefore influences the financial stability of any market and consequently the stability of the whole economy. Furthermore, liquidity is important to both investors and firms, as it determines their cost of buying and selling and hence assures the ease and speed of trading a security without considerable changes in prices.

Given its crucial importance, several studies have examined the link between corporate policies and various aspects of stock liquidity.[1] This great interest can generally be attributed to the general belief that changes in corporate policies can impact the behaviour of market players, the functioning of stock market liquidity, asset pricing, and market efficiency.

Dividend policy is one of the firm's main corporate policies. It can be defined as the decision made by the managers concerning the size and pattern of profits distributed to the firm's shareholder.[2]Over the years, many researchers have addressed different issues relating to dividend policy and proposed numerous theories to explain why firms pay dividends to shareholders and what the implications of such a decision are. From a managerial point of view, dividends can be used as a means to reduce agency problems by distributing excess-free cash flows (Jensen 1986) or to

[1] Several studies have examined the impact of corporate policy on liquidity. Maloney and Mulherin (1992) and Lin et al. (2009) examine changes in liquidity around the execution of a stock split. Barclay and Smith (1988), Brockman and Chung (2001) and Ginglinger and Hamon (2007) examine changes in liquidity after announcements of open-market share repurchases. Andres et al. (2014) examine the effect of capital structure on stock liquidity.

[2] The main focus of this thesis is cash dividends. This would be a limitation as the firm dividend policy may consist of other types of payouts, such as stock dividends or share repurchases. We mention this limitation in the limitation section (see page 209).

convey information to the market that only good-quality firms are able to pay dividends (Bhattacharya 1979). However, investors may view dividends as a source for regular income which helps them to avoid any irrational trading (Shefrin and Statman 1984).

Dividend policy has been investigated extensively over the last few decades in an attempt to explain why firms pay dividends and what the effect of dividend policy on the market is, leading to the development of several theories. Generally, these theories can be divided into two groups: the irrelevance theory and the relevance theories. The irrelevance theory of Miller and Modigliani (1961) suggests that under perfect market conditions, a firm's dividend policy does not have any impact on its market value. It has been supported by several subsequent studies including Black and Scholes (1974), Miller (1986), and Bernstein (1996). The relevance theories (e.g., asymmetric information theory and agency costs theory), however, assert that dividend policy has an impact on a firm's market value. Despite extensive empirical investigation, there is no consensus in the literature on whether dividend policy affects firm value. The asymmetric information theory (Bhattacharya 1979; John and Williams 1985; Miller and Rock 1985) and agency costs theory (Easterbrook 1984; Jensen 1986) suggest that dividend payments positively affect firm value. For example, the asymmetric information argument implies that dividends convey information about the future prospects of the firms. Due to their information content, dividends are perceived as a signal of a firm's financial strength. Many studies find evidence consistent with this argument (Aharony and Swary 1980; Abeyratna et al. 1996; Bali 2003; Bozos et al. 2011; Dasilas and Leventis 2011). The agency costs argument suggests that separation of management and ownership results in agency costs that can be mitigated by dividends. Consistent with the view that dividends reduce agency costs, several studies document a positive relationship between dividend policy and the stock price (see, e.g., Rozeff 1982; La Porta et al. 2000).

However, despite the voluminous research on dividend policy, prior empirical studies have focused mainly on the impact of dividend policy on firm performance and have paid little attention to a potential link between dividends and stock liquidity. This thesis contributes to the literature by investigating the link between dividend policy and the various aspects of stock liquidity. It consists of three empirical chapters, each examining a certain question. The first empirical chapter examines the relationship between dividend policy and different aspects of stock liquidity. The second empirical chapter investigates the effect of dividend policy on systematic liquidity risk. The third empirical chapter analyzes the relationship between dividend policy and stock price informativeness and how stock liquidity can affect this relationship.

The literature on dividend policy proposes several channels through which dividend decisions affect stock liquidity. According to the asymmetric information theory, since dividends reveal information to the market (Bhattacharya 1979; Miller and Rock 1985), information asymmetry should decrease and hence the bid–ask spreads should narrow. Moreover, the agency model implies that dividends can be used as a tool to reduce the agency costs because paying dividends means that the firm will visit the capital market more frequently, leading to increased monitoring by suppliers of capital (Easterbrook 1984). However, those new capital suppliers will not provide funds without obtaining information about the potential use of those funds (Rozeff 1982). As a result, new information will be released to the market, resulting in reduced information asymmetry levels and hence lower trading costs. With regards to the clientele theory of dividends, it suggests that investors usually select firms with payout policies that fit their preferences, and this creates clienteles for both high and low dividends (Dhaliwal et al. 1999; Allen et al. 2000; Hotchkiss and Lawrence 2007). According to this theory, institutional investors prefer higher dividends relative to individual investors (Grinstein and Michaely 2005). Given that institutional investors are more effective in gathering information about the firms in which they invest, the level of information asymmetry between firm insiders and outsiders is lower for firms that pay dividends (Amihud and Li 2006; Puckett and Yan 2011). Additionally, many studies find that institutional investors trade more frequently and in large quantities (Agarwal 2007; Rubin 2007; Brockman et al. 2009). Therefore, if dividends attract institutional investors, who can produce high information quality and trade large quantities, dividend-paying firms should have lower trading costs and higher trading activity, and therefore higher stock liquidity, than their non-dividend-paying counterparts.

Existing empirical evidence on the effects of dividend policy on stock liquidity is inconclusive and in some cases outdated. Some studies have argued that dividend policy leads to a narrower bid–ask spread which increases stock liquidity (Howe and Lin 1992; Mitra and Rashid 1997). However, Brooks (1994) and Barclay and Smith (1988) show that the relationship between dividend policy and bid–ask spread is at best weak. With regards to the trading activity aspect of stock liquidity, several studies, including Richardson et al. (1986), Gurgul et al. (2003), and Dasilas and Leventis (2011), find that trading volume increases with dividend increases and declines with dividend reductions.

Recently, the liquidity literature has shifted focus from studying individual stock liquidity to the concept of systematic liquidity risk. Chordia et al. (2000) suggest that liquidity is a source of non-diversifiable risk that should be reflected in expected asset returns. Following that, many studies, including Pástor and Stambaugh (2003), Acharya and Pedersen (2005), and Liu (2006), provide significant evidence that systematic liquidity risk is priced. Given this recent development in the liquidity literature, we argue that given that liquidity is priced, an increase (decrease) in stock liquidity associated with dividends may result in lower (higher) liquidity risks, which in turn will lower (higher) the cost of equity. This thesis examines the valuation effect of dividend policy through stock liquidity as well as systematic liquidity risk.

Dye and Sridhar (2002) note that in contrast to the usual view of the information flows between capital markets and firms being one way (from firms to the capital markets), information also flows from capital markets to firms. Hence, corporate dividend policy can both affect and be affected by capital markets. Therefore, this thesis also links the dividend policy to the concept of stock price informativeness. Recently, great attention among finance researchers has been paid to investigate whether the stock market can affect firm corporate decisions through the informational content of stock prices (Chen et al. 2007a; Bakke and Whited 2010; Frésard 2012; Ben-Nasr and Alshwer 2016). Understanding whether and how information flows from the stock market to firms is of vital importance to enable better assessment of the impact of financial markets on the firm. The basis behind this is that information does not flow freely among firms and investors, and hence various types of information that are not known by managers can be aggregated into the stock prices through the trading activities of different investors (Grossman and Stiglitz 1980; Kyle 1985; Chen et al. 2007a; Kim and Cheong 2015). As a result, market prices may incorporate some specific information that can help managers in allocating the corporate resources more efficiently, thus they may contribute to increase firm value. Accordingly, the stock market can have a real impact on corporate policies if managers discover information in the market with the aim of making better decisions.[3]

A growing body of literature in finance suggests that managers care about outside investors' information contained in stock prices and use that information when making corporate decisions. Numerous studies document the fact that managers observe information from stock prices and use this information when they decide on, e.g., corporate investment (Durnev et al. 2004; Luo 2005; Chen et al. 2007a; Bakke and Whited 2010), cash savings (Frésard 2012), and labour investment (Ben-Nasr and Alshwer 2016). However, to the extent that prices reflect information about a firm's fundamentals, this information should also affect other corporate decisions that managers have to make (Frésard 2012). We contribute to this strand of literature by examining the extent to which managers use the information incorporated into stock prices in their dividend policy decisions.

1.2. Findings and contributions to literature

This thesis contributes to the existing literature by examining the links between dividend policy, stock liquidity, systematic liquidity risk, and price

[3] See Bond, et al. (2012) for a comprehensive survey on the real effects of the stock markets from the informational role of market prices.

informativeness. The contributions and the findings of each empirical chapter can be summarized as follows:

1.2.1. Dividend policy and stock liquidity

In Chapter 3, the first empirical chapter of the thesis, we investigate the relationship between dividend policy decisions and level of stock liquidity. Existing empirical evidence on the effects of dividend policy on stock liquidity effects is mixed. For example, Howe and Lin (1992) show that dividend policy has a negative effect on bid–ask spread. They attribute their results to the information asymmetry theory. They argue that dividends reduce the level of information asymmetry and hence the bid–ask spread. However, Brooks (1994) and Barclay and Smith (1988) show that the relationship between dividend policy and bid–ask spread is at best weak. With regards to the trading activity aspect of stock liquidity, several studies, including Richardson et al. (1986), Gurgul et al. (2003), and Dasilas and Leventis (2011), find that trading volume increases with dividend increases and declines with dividend reductions. Overall, existing empirical evidence on the consequences of dividend policy decisions in terms of stock liquidity is not conclusive and in some cases is outdated. This study also notices that most of the studies on the relationship between dividend policy and stock liquidity use data from the US market. Their results, however, cannot be readily extended to other countries where stock markets can have different market structure and liquidity characteristics. We fill this void in the literature by examining the impact of dividend policy on stock liquidity using a UK sample.

This chapter makes several contributions to the literature. We contribute to the literature on the link between stock liquidity and corporate finance. For example, many studies show that stock liquidity is influenced by stock repurchases (Brockman and Chung 2001; Ginglinger and Hamon 2007; Hillert et al. 2016), asset liquidity (Gopalan et al. 2012; Charoenwong et al. 2014), stock split (Goyenko et al. 2006; Huang et al. 2015), and corporate governance (Rubin 2007; Poon et al. 2013; Prommin et al. 2014). We contribute to this literature by identifying dividend policy as another influential determinant of liquidity. Given the few prior studies that examine the liquidity impact of dividend policy and their conflicting results, more empirical studies are warranted. Previous studies mainly investigate the relationship between dividend policy and stock liquidity by examining the changes in a certain measure of stock liquidity following dividend announcements (Richardson et al. 1986; Mitra and Rashid 1997; Bozos et al. 2011; Dasilas and Leventis 2011). However, our study uses regression analysis, which allows examining the impact of dividends on stock liquidity after controlling for other known determinants of liquidity and potential endogeneity bias.

Previous studies focus typically on the effect of dividend policy on a single aspect of stock liquidity, such as trading costs, which are measured by bid–ask spread (Howe and Lin 1992; Mitra and Rashid 1997), or trading activity, which is measured by trading volume (Richardson et al. 1986; Bozos et al. 2011; Dasilas and Leventis 2011). However, stock liquidity reflects several aspects. Kyle (1985) and Lesmond (2005) argue that because liquidity is very difficult to define and even more difficult to estimate, a list of measures is necessary to capture the different aspects of liquidity. Given the uncertainties surrounding liquidity estimation, we use proportional bid–ask spread, turnover ratio and Amihud's (2002) illiquidity ratio to capture the impact of dividend policy on trading costs, trading quantity and price impact dimensions of liquidity, respectively.

Further, our study complements earlier studies of the impact of dividend policy on firm value. Higher stock liquidity that is associated with dividend payments can result in lower rate of return and higher firm valuation.[4]

Finally, to the best of the author's knowledge, this study is the first of its kind that examines the role of dividend policy decisions in determining stock liquidity in the UK. It is vital that we research this area given that the London Stock Exchange (LSE) is the second most active equity market in the world after the USA.

The main findings of this chapter can be summarized as follows. Stocks of dividend payers tend to have significantly lower bid–ask spread and a

[4] The impact of liquidity on rate of return has been documented widely (see, e.g., Amihud and Mendelson 1986; Brennan et al. 1998; Amihud 2002).

illiquidity ratio than their non-dividend payers' counterparts. Likewise, stocks of firms that pay high dividend amounts have lower bid–ask spread and a lower illiquidity ratio compared to those that pay a low dividend amount. These findings are consistent with the predictions of the asymmetric information theory of Bhattacharya (1979), which suggests that dividends convey information to the market and hence decrease the level of asymmetric information, which leads to higher stock liquidity. These findings are also in line with the model of Easterbrook (1984), which posits that dividend-paying firms are more likely to visit the capital market, leading to more monitoring and hence more information being released to the market. However, the turnover ratio is found to be affected negatively by dividend policy. This result hinges upon the view that stocks that pay dividends tend to be purchased and retained by the investors, and thus their transactions occur less frequently (Hotchkiss and Lawrence 2007; IOSCO Emerging Markets Committee report December 2007). Our main results are robust to different model specifications and estimation methods.

In our further analysis, which examines whether the relationship between dividend policy and stock liquidity is affected by the size of the firm, we find that compared to firms with no or low dividends, dividend-paying firms and firms with high dividends have significantly higher levels of stock liquidity, especially when they are larger. These findings are again consistent with information asymmetry theories, as large firms often face lower degrees of asymmetric information, which may explain their greater level of stock liquidity.

1.2.2. Dividend policy and systematic liquidity risk

In Chapter 4, the second empirical chapter of the thesis, we investigate the relationship between dividend policy and systematic liquidity risk. The relationship between dividend policy and firm value is a crucial area of research in the field of corporate finance. The positive value effects of dividend policy decisions are well documented in the literature. For example, many studies find strong evidence that decisions to increase dividends can result in positive abnormal returns (Abeyratna et al. 1996; McCluskey et al.

2006; Al-Yahyaee et al. 2011) as well as positive abnormal volume (Gurgul et al. 2003; Bozos et al. 2011; Dasilas and Leventis 2011). DeAngelo et al. (1996), Nissim and Ziv (2001), Braggion and Moore (2011), and Liu and Chen (2015) find that dividend policy can predict subsequent accounting earnings. Recently, risk has been proposed as one of the important factors in explaining the well-known value effects of payout policies (Grullon et al. 2002; Eije et al. 2014). We build on this literature and investigate whether dividend policy has an impact on systematic liquidity risk, a form of risk that has been shown to be priced by investors both in the US and across the world (e.g., Acharya and Pedersen 2005; Lee 2011; Li et al. 2014; Ho and Chang 2015) but has not yet been investigated in the context of dividend policy decisions.

There are reasons why dividend policy may affect systematic liquidity risk. First, several studies show that dividend payments are associated with higher stock liquidity. For example, it has been documented that stocks of dividend payers have lower bid–ask spread than stocks of non-payers (Howe and Lin 1992) and that the spread declines following dividend increases (Mitra and Rashid 1997). Gurgul et al. (2003) and Dasilas and Leventis (2011) find that trading volume increases (decreases) following dividend increases (decreases). Several studies find a positive association between individual stock liquidity and stock market returns (see, e.g., Amihud and Mendelson 1986; Chalmers and Kadlec 1998) and that liquidity is a source of non-diversifiable risk that should be reflected in expected asset returns (see, e.g., Chordia et al. 2000; Hasbrouck and Seppi 2001; Huberman and Halka 2001; Brockman and Chung 2002). Thus, if dividend policy affects stock liquidity, it should also affect the resilience and the vulnerability of stock prices to shocks in market liquidity. In other words, if dividend payouts improve the liquidity environment, they should reduce the systematic liquidity risk and the cost of equity. Second, dividend payments reduce uncertainty and adverse selection (see, e.g., Grullon et al. 2002; Hoberg and Prabhala 2009; Fuller and Goldstein 2011; Eije et al. 2014), and thus could reduce liquidity risk by reducing the sensitivity of a firm’s share price to the non-diversifiable component of risk. For example, during times of market liquidity drops, there is generally selling pressure on equities (Pástor and Stambaugh 2003; Ng 2011). Non-dividend-paying stocks and stocks that pay a low amount of dividends could experience more negative returns if buyers offer lower prices to sellers of these stocks because of the higher uncertainty and/or greater probability of adverse selection associated with them. Furthermore, when the aggregate market liquidity is low, the liquidation cost of stocks becomes higher. Therefore, investors are more likely to invest in dividend-paying firms and firms that pay high dividends because dividend payments help them avoid the high trading costs (Banerjee et al. 2007; Kuo et al. 2013).[5] Pástor and Stambaugh (2003) argue that when the aggregate liquidity is low, assets with high sensitivity of returns to aggregate liquidity result in a reduction in investor wealth. Therefore, dividends are expected to reduce the sensitivity of stock returns to aggregate liquidity.

This chapter makes at least two contributions. First, we contribute to the growing literature linking systematic liquidity risk to corporate finance (e.g., Lin et al. 2009; Ng 2011; Cao and Petrasek 2014; Mazouz et al. 2014) by investigating the impact of dividend policy decisions on the systematic liquidity risk. In this context, only one study has been found in the USA – Banerjee et al. (2007) – which shows that systematic liquidity risk declines following dividend initiations. Our study, however, differs from Banerjee et al.'s (2007) study in two ways. First, their study focuses on only dividend initiations, i.e., the decision as to whether the firm pays a dividend (and not how much to pay). This is a considerable drawback, because the empirical research on dividend decisions suggests that firm managers are more likely to face decisions related to the level of dividends than decisions to either introduce dividends for the first time or eliminate existing dividends (Li and Lie 2006). Second, the results of Banerjee et al.'s (2007) study are based on a univariate analysis in which they compare the pre- and post-initiation liquidity risk using a sample of firms that initiate dividends and do not control

[5] When liquidity is low, trading friction is high throughout financial markets which means that investors have to pay high trading commissions and they either have to provide a price concession for an immediate execution or they have to wait until optimal execution of their trades. Stocks that pay cash dividends allow investors to satisfy their liquidity needs with less or no trading and thus enable them to avoid trading friction (Banerjee et al. 2007).

for the known determinants of systemic liquidity risk. Since systematic liquidity risk is not expected to have the same effect on all firms, the exclusion of the control variables may give rise to an omitted variables bias. We alleviate this potential bias by applying panel data analysis and including the commonly known determinants of liquidity risk. This is necessary to understand whether, and why, individual firms display varying sensitivity to market liquidity. Second, we contribute to the literature on the valuation effects of dividend policy (Al-Yahyaee et al. 2011; Bozos et al. 2011; Dasilas and Leventis 2011; Liu and Chen 2015). Recent literature in finance suggests that liquidity risk is a non-diversifiable systematic risk that affects stock returns. Many studies find that expected stock returns are positively related to the sensitivities of returns to fluctuations in aggregate liquidity (Pástor and Stambaugh 2003; Acharya and Pedersen 2005; Liu 2006) Liquidity risk is also significant and priced in different markets, suggesting that it is a persistent risk that affects firm value (Lee 2011). To the best of our knowledge, we are the first to introduce systematic liquidity risk as an important factor by which dividend policy can affect firm value.[6]

We find that non-dividend paying firms exhibit significantly higher systematic liquidity risk than their dividend-paying counterparts. We also find that the systematic liquidity risk of dividend payers is significantly negatively associated with the amount of dividend payments. These findings remain robust after controlling for endogeneity due to the possibility that the relations between dividend policy and systematic liquidity risk are endogenously determined and it could be as an outcome of omitted variables. The findings also continue to hold as we use alternative proxies for liquidity and alternative models to estimate liquidity risk. Further analysis reveals that compared to non-dividend-paying stocks, dividend-paying stocks have a significantly lower systematic liquidity risk, especially when they are small and have more growth opportunities. When liquidity declines, investors are more likely to sell off stocks that are associated with higher asymmetric

[6] We do not empirically document the linkage between liquidity risk and firm value in this thesis. Instead, we rely on the large body of empirical evidence in market microstructure that documents the linkage between liquidity risk and returns and hence firm value (see e.g., Pástor and Stambaugh 2003; Acharya and Pedersen 2005; Liu 2006).

information (Ng 2011). Small- and high-growth stocks are often associated with higher asymmetric information because they tend to have a lower amount of information (Smith and Watt 1992; Leary and Michaely 2011).

The findings of this chapter suggest that systematic liquidity risk is significantly associated with dividend policy decisions. These findings are consistent with the predictions of asymmetric information theory, which suggests that dividend payments are associated with lower asymmetric information and hence higher liquidity (e.g., Bhattacharya 1979; Miller and Rock 1985). Our result is also in line with the arguments of Amihud and Mendelson (1986), Pástor and Stambaugh (2003), and Liu (2006) who suggest that since liquidity is priced, an increase in liquidity will lead to lower liquidity risk and, hence, lower expected returns. Our findings are also consistent with the flight-to-quality phenomenon (Acharya and Pedersen 2005; Brunnermeier and Pedersen 2009) in which adverse liquidity shocks force investors to sell off assets that are associated with higher uncertainty, asymmetric information and trading costs, leading to decline in asset prices. Banerjee et al. (2007) argue that during periods of low market liquidity, the demand of investors for dividend-paying stocks, and thus the value of such stocks relative to non-paying stocks, is higher.

1.2.3. Dividend policy, stock price informativeness and stock liquidity

In the third empirical chapter (Chapter 5), we investigate the relationship between amount of dividend paid and stock price informativeness and how stock liquidity affects this relationship. Existing literature provides extensive evidence on the link between stock prices and managerial corporate decisions (Durnev et al. 2004; Luo 2005; Chen et al. 2007a; Bakke and Whited 2010; Frésard 2012; Ben-Nasr and Alshwer 2016). This evidence has motivated us to test the impact of stock price informativeness on dividend decisions. This chapter argues that stock price informativeness may impact dividend payments in two ways. First, stock prices contain information about future investment and growth opportunities, discount rates and financing opportunities, which may affect dividend decisions (Bhattacharya 1979; Miller and Rock 1985; Fama and French 2001; Nissim and Ziv 2001; Grullon et al.

2002; Hoberg and Prabhala 2009; Abor and Bokpin 2010; Wang 2010; Ardestani et al. 2013). It is predicted that at a high level of stock price informativeness, firm managers are less likely to distribute a high level of dividend payments to provide positive signals about firms' prospects and future cash flows as investors are already well informed. Second, more informative stock prices are associated with better monitoring of managers (Holmström and Tirole 1993; Ferreira et al. 2011; Ben-Nasr and Alshwer 2016), hence reducing the agency costs between managers and investors. Consequently, the role of dividends in controlling agency costs is reduced, leading to a decrease in dividends (Liu 2002; Jiraporn and Ning 2006; Chae et al. 2009; Esqueda 2016). Overall, a negative relationship between stock price informativeness and dividend payments is predicted.

This chapter contributes to the literature in a number of ways. First, while existing studies have identified several determinants of dividend policy, little attention has been paid to whether and how capital markets affect dividend policy. This chapter contributes to the literature by adding stock price informativeness to the list of the determinants of dividend policy. Second, some existing studies highlight the existence of an informative feedback going from the stock market to different corporate decisions, such as investments (Chen et al. 2007a; Bakke and Whited 2010), cash savings (Frésard 2012) mergers and acquisitions (Luo 2005), and labour investments (Ben-Nasr and Alshwer 2016). This chapter adds to this research by investigating whether managers' decisions regarding the amount of dividends are influenced by the information content of prices. Recently, De Cesari and Huang-Meier (2015) found that changes in quarterly dividends are positively related to abnormal returns and that this relationship is stronger when stock returns are more likely to convey new private information to managers. Our study differs from De Cesari and Huang-Meier (2015) in that their focus is on how the sensitivity of dividend changes to abnormal returns depends on the stock price informativeness. We, however, focus on the direct effect of stock price informativeness on dividend policy by studying its effects on amount of dividend paid. We propose that the content of stock price information affects firms' choice of dividends as a signalling device and as a monitoring mechanism. Based on the signalling model and agency costs model, we argue that the amount of information incorporated into prices affects firms' choice of dividends as a signalling device and as a monitoring mechanism. This adds a new explanation for using payout policies for signalling purposes (Bernheim and Wantz 1995; DeAngelo et al. 2000; Grullon et al. 2002; Hail et al. 2014) as well as contributing to the literature on the interaction between dividends and other monitoring mechanisms (Grinstein and Michaely 2005; Grullon and Michaely 2012; Al-Najjar and Belghitar 2014; Hoberg et al. 2014; Chang et al. 2016). To the best of our knowledge, this study is the first to examine whether dividends are affected by the level of stock price informativeness based on signalling and agency models.

Finally, we argue that stock liquidity may play a role in the impact of stock price informativeness on dividend amount. More specifically, the association between stock price informativeness and amount of dividends is likely to be stronger in illiquid firms. Our argument is motivated by the evidence of the greater importance of dividends for firms with illiquid stocks than liquid stocks. Firms with illiquid stocks are more likely to pay dividends than liquid stocks (Banerjee et al. 2007; Kuo et al. 2013). Moreover, firms with illiquid stocks are associated with higher levels of asymmetric information (Welker 1995; Richardson 2000), and hence the need for dividends to reduce it is more valuable in these firms. Therefore, we further contribute to the literature by examining the effect of stock liquidity on the price informativeness-dividend relationship.

We report a negative relationship between stock price informativeness and amount of dividend paid, suggesting that firm managers are more likely to maintain a relatively low level of dividends when stock price informativeness is high because investors are already well informed of firms' future cash flows and prospects. This finding also implies that given that more informative stock prices lead to a better monitoring of managers (Ferreira et al. 2011), managers are less likely to use dividends as a mechanism to reduce agency costs, leading to a lower dividend payment. We further find that the effect of price informativeness on dividends is only observed in small firms, which is consistent with the argument based on the signalling model. Further, the negative relation price informativeness and dividends is only seen in firms with low growth and those with low leverage ratio, consistent with the argument based on the agency costs.

We find that our results are robust to the use of alternative estimates of firm-specific return variations as measures of stock price informativeness. Our finding also remains robust when we control for endogeneity issues resulting from unobservable heterogeneity, simultaneity and the possibility that the stock price informativeness is a function of dividends, as firms with high levels of dividend payments could have greater stock price informativeness. Actually, the result remains qualitatively unchanged when we use the firm fixed-effects model, change-in-variables approach and dynamic Generalized Method of Moments (GMM) model.

We also address the role of stock liquidity in the relationship between stock price informativeness and amount of dividend paid. We find that the negative relationship between stock price informativeness and dividends is stronger for firms with illiquid stocks, confirming our conjecture that the effect of stock price informativeness on the role of dividends as an informational tool and a monitoring mechanism is stronger in firms that are exposed to more asymmetric information and trading frictions.

1.3. Structure of the thesis

The remainder of the thesis is structured as follows. Chapter 2 provides some background on dividend policy and stock liquidity. It discusses the main theories of dividend policy, defines liquidity, discusses its dimensions and explains its measures. Chapter 3, the first empirical chapter, examines the impact of the dividend policy on stock liquidity. Chapter 4, the second empirical chapter, investigates the effect of dividend policy on systematic liquidity risk. Chapter 5, the third empirical chapter, highlights the relationship between stock price informativeness and dividends and how stock liquidity can affect this relationship. Chapter 6 concludes the thesis.

Chapter 2: Related Literature

2.1. Introduction

This chapter outlines some of the relevant literature on dividend policy and stock liquidity. Dividend policy represents one of the key financial decisions because of its direct connection to shareholders and its relationship with other major corporate decisions, such as financing and investment decisions. According to Lease et al. (2000), dividend policy refers to the practice that managers follow when making decisions about the size and pattern of cash distributions to shareholders regularly. The issue of dividends has captured the attention of finance researchers since the middle of the 20th century. Several theories have been developed to explain the dividend behaviour of firms. Nevertheless, dividend policy remains one of the most challenging issues in finance (Allen et al. 2000). Black (1976: 5) states that "…the harder we look at the dividend picture, the more it seems like a puzzle, with pieces that just don't fit together".

One of the seminal studies on dividend policy is that by Miller and Modigliani (1961), who suggest that dividend policy is not vital because it has no impact on the value of the firm and hence does not affect shareholder wealth. Miller and Modigliani (1961) argue that firm value is determined solely by its earning power and its business risk and not on how the income is allocated between dividends, stock repurchases and retained earnings. They show that, in perfect capital markets, dividend policy is irrelevant and the firm value is independent of its payout policy. According to them, investors are indifferent between share repurchases and dividends as they can imitate any desirable payout either through selling holdings in the firms that don't pay dividends or by reinvesting their dividends. Moreover, DeAngelo and DeAngelo (2006) argue that the assumptions of Modigliani and Miller are perfectly proper for proving that dividing a given cash payout between dividends and repurchases is a matter of indifference in frictionless markets.

While many researchers support this theory, others have suspicions about it. Several studies suggest that in a world of market imperfections, such as transaction costs, taxes, and information asymmetries, dividend policy seems to be important for both managers and shareholders. For example, managers tend to show extra care in their payout decisions as the decision to distribute cash dividends determines the amount of funds available for managers to reinvest. For investors, dividends are not only a means of regular income, but dividend announcements can signal important information about firms' future performance. Moreover, investors who want to sell their stocks will incur costs, while investors who hold dividend-paying stocks can meet their liquidity needs with less or no cost, and hence avoid trading frictions.

Several studies investigate the reason why firms pay dividends and the potential effect of dividend policy on firm value. A large body of the empirical investigation focuses on the impact of dividend policy on stock prices, and consequently the extent of its contribution to achieve management's optimal target of maximizing the market value of shares and thus maximizing shareholders' wealth. Miller and Modigliani's (1961) irrelevance theory, which claims that dividends do not impact share price, has been supported by several empirical studies, including that by Black and Scholes (1974), Miller (1986), and Bernstein (1996).

Some researchers (e.g., Gordon 1963) suggest that dividends can increase firm value and shareholders wealth due to the "bird in the hand" hypothesis. According to this hypothesis, more certainty is attached to dividend payments received now, against earnings retained for investment in projects with future earnings that are not certain. Firms should, therefore, pay high dividends and offer high dividend yields to maximize their share. However, there are other theories such as the tax preference theory (Brennan 1970; Litzenberger and Ramaswamy 1979) which argues that, in the existence of market imperfections such uneven tax treatments, dividend payments can decrease firm value and result in negative consequences for shareholders wealth. Accordingly, firms should avoid or make low dividend payments if they want to maximize their share prices.

On the other hand, signalling theory (Bhattacharya 1979; John and Williams 1985; Miller and Rock 1985) and agency costs theory (Easterbrook 1984; Jensen 1986) suggest that increasing dividend payments increases share price. Consistent with the signalling argument, several studies show that stock prices exhibit a significant increase following announcements of dividend initiation or increase and significant decline subsequent to announcements of dividend elimination or cut (Aharony and Swary 1980; Abeyratna et al. 1996; Bali 2003; Bozos et al. 2011; Dasilas and Leventis 2011). Several other studies show that dividend policy reduces the agency costs associated with separation of ownership and control (see, e.g., Rozeff 1982; La Porta et al. 2000).

Overall, existing evidence on the effect of dividend payments on firm value, and hence shareholders' wealth, is mixed and inconclusive. The current study aims to contribute to the literature by identifying the potential channels through which dividends can affect shareholder wealth. Dividends could potentially affect firm value by affecting the trading environment of the firm's stock, namely by changing the information environment and the liquidity of the stock. Leuz and Verrecchia (2000) suggest that stock liquidity proxies for the quality of the firm's information environment. In particular, any improvement in stock liquidity associated with dividend payment can be explained as a result of the decreased level of information asymmetry between firm managers and investors, as well as between different groups of investors after dividend payment.

Liquidity is one of the characteristics of securities markets that firm managers are concerned about, because it has a marked impact on trading costs and shareholders' required rate of return, which in turn affects the firm's value (see, e.g., Baker and Pettit 1982; Wan 2001; Bilinski et al. 2012). Amihud and Mendelson (1986) argue that since liquidity can increase value, firms are more likely to follow a corporate policy that makes their stocks more liquid. Since stock liquidity can have critical implications for several finance areas, including asset pricing, stock market performance, and, most importantly, corporate policies, many researchers study the issue of stock liquidity.

The remainder of this chapter is organized as follows. Section 2.2 discusses the main theories of dividend policy. Section 2.3 defines the concept, the dimensions and the different measures of liquidity. Section 2.4 summarizes and concludes.

2.2. Theories of dividend policy

A wide range of theories have been developed to explain the issue of dividend policy. These include dividend irrelevance theory, the information content of dividends (signalling), agency-cost hypothesis, clientele effect theory, and the life cycle theory.[7]

2.2.1. Irrelevance theory

Irrelevance theory stems from a study by Miller and Modigliani (1961), who argue that dividend policy does not affect a firm's cash flows or its cost of capital. This argument is based on the assumptions of perfect capital markets and rational investors, which can be summarized as follows: (1) there are no tax differences between dividends and capital gains; (2) there are no flotation and transaction costs when securities are traded; (3) information is symmetrical and costless (i.e., all market participants have free and equal access to the same information); (4) there is no conflict of interests between managers and shareholders, and hence no agency costs; and (5) all market participants are price takers.[8]

According to the irrelevance theory, each dollar distributed to shareholders represents a capital loss of a dollar, and hence more external financing is required to finance future projects with net present value. Accordingly, firm value is affected by investment policies, rather than financing policies. Miller and Modigliani (1961: 414) state that "…given a firm's investment policy, the dividend payout policy it chooses to follow will affect neither the current price

[7] In this thesis, dividend policy is considered as a policy that involves making decisions regarding distributing the firm's profits to investors in the form of cash dividends or keeping them in the firm for investments. Therefore, all the literature discussed in this section is related to cash dividends relative to retained earnings.

[8] "Price takers" refers to the fact that no buyer or seller (or issuer) of securities is large enough for their transactions to have an appreciable impact on the currently ruling price (Miller and Modigliani, 1961).

of its shares nor the total returns to shareholders". They also argue that all dividend policies are in fact the same to all investors, since the latter can build "homemade" dividends by changing their portfolios in a manner that matches their preferences. Consequently, shareholders would be indifferent between dividends and capital gains as the value of their wealth is only influenced by the income generated by the investment decisions, and not by how this income is distributed (Black and Scholes 1974; Miller 1986; Bernstein 1996).

A number of empirical studies provide support for the dividend irrelevance theory. For example, Black and Scholes (1974) study the effect of dividend policy on stock prices by investigating the relationship between dividend yield and stock returns. They create 25 portfolios of stocks listed on the New York Stock Exchange (NYSE) and use the capital asset pricing model (CAPM) to examine the dividend yield effects. They find that dividend increase does not have a permanent impact on stock prices. They attribute the temporary changes in prices following dividend changes to investors' believes that the change in dividend is an indication of a shift in future earnings. They conclude that neither high-yield nor low-yield dividend policies influence stock prices. Hess (1982), Miller and Scholes (1982), and Bernstein (1996) provide evidence to support the irrelevance theory of dividends, and confirm that dividend policy has no effect on the firm's stock price. Moreover, Miller and Rock (1985) argue that dividends are a tool for signalling information on earnings to the market, and, consequently, the price reaction to dividend changes is actually a reaction to earnings, rather than dividends.

However, other researchers provide evidence that challenge the irrelevance argument. For example, Ball et al. (1979) examine the effect of dividend policy on firm value in Australia over the period 1960 to 1969, and do not find any evidence to support Miller and Modigliani's irrelevance theory. However, they find a significant relationship between stock returns and dividend yield in the year following dividend payment. Using a survey of chief financial officers of 562 US firms listed on the NYSE, and based on 318 responses, Baker et al. (1985) provide evidence that a firm's dividend policy does indeed influence its stock price. In a similar study, Baker and Powell (1999) survey

603 CFOs of firms listed on the NYSE. Based on 198 responses, they find that 90% of respondents believe that dividend policy has an impact on firm value. Using a sample of US banks, Siddiqi (1995) and Casey and Dickens (2000) also show that dividend policy is an important determinant of firm value.

2.2.2. Asymmetric information (signalling) theory

In Miller and Modigliani's (1961) irrelevance hypothesis on the effect of dividend policy on firm value, one of their main assumptions is that all investors have the same perspective regarding the firm. In other words, they assume that all investors possess the same information about the firm and are able to understand and translate this information in the same way, as well as managers and investors have the same information and, hence the same expectations, about the firm. In real markets, however, asymmetric information between market participants exists and investors and managers have different information and expectations about the firm's future profitability and risk. Moreover, managers are likely to possess better information about the firm's future performance than outside investors. Since managers can access information that may not be available to outsides, they may use dividend policy as a means to convey such information to investors (e.g., Bhattacharya 1979; Miller and Rock 1985; Bali 2003). Therefore, dividend policy can affect firm value by decreasing the information gap between managers and investors.

The theory of asymmetric information was first developed in the beginning of the 1970s, and was applied to the field of finance in the 1980s. The developers of this theory are Akerlof (1970), Spence (1973), and Stiglitz (1975), who were awarded the Nobel Prize in Economics science in 2001 for their research on information asymmetry. Akerlof (1970) investigate the cost of information asymmetry using the used-car market as a pooling equilibrium in the absence of signalling activities. Spence (1973) focuses on the labour market and carries out a formal partial equilibrium analysis of market signalling. Spence's signalling model has been used extensively by others to test different economic and finance issues, and has become one of the main theories of dividend policy.

Bhattacharya (1979) argues that managers use dividends as a mechanism to convey information about their firms' future prospects to the market. Specifically, he structures a two-period signalling model and assumes that under conditions in which outsider investors have imperfect information about firms' profitability, any change in dividends conveys information on managers' views of firm's future prospects to the market. According to Bhattacharya's two-period model, at the beginning of the first period, the firm announces that it will pay dividends at the end of this stage based on manager's confidence in the coming investment. However, when investments cannot realize the expected returns to cover the announced dividend payments, the firm is forced to generate external finances to meet the dividend payments. After paying dividends, part of the ownership will be transferred to new shareholders, who receive the firm's payoffs generated at the end of the second period. Since the issuance of new securities can be costly, firms with low profitable investment opportunities would face higher financing costs for the same level of dividend payments. Moreover, the transaction costs of issuing new stocks discourage low-quality firms from replicating the dividend policy of high-quality firms. Bhattacharya (1979) argues that dividend payment is a costly signal, and hence only good firms can afford to announce them. Therefore, firms with negative future prospects cannot use dividends as a signal, and investors pay a higher tax associated with dividends because they believe that higher dividends put a premium on the value of a firm that is entirely equity-financed, while the advantages of dividends exceed their tax disadvantage.

Building on Bhattacharya (1979) work, Talmor (1981) develops a multi-period signalling model in which different valuation parameters are employed. He argues that dividend policy is only one of the financial decisions that managers must make, and each of these decisions can serve as a signalling device. Talmor's (1981) model assumes that in each period, different financial decisions are determined simultaneously by taking into consideration their impact on firm value. Hakansson (1982) adds to the model of dividend signalling by suggesting three mutually exclusive conditions under which dividend policy is proven to be informative: (1) heterogeneous beliefs among investors, (2) an incomplete financial market, and (3) non-time additive utility.

Myers and Majluf (1984) assume that insiders have better information than outsider regarding the firm’s future prospects and can transmit this information to outsiders through unexpected changes in dividend policy. Miller and Rock (1985) propose a two-period signalling model in which they assume that firm’s managers have more information about the position of the firm than shareholders do. In this model, at the beginning of the first period, the firm invests in a project whose profitability cannot be observed by outsider investors. At the end of the first period, the project generates earnings that the firm uses to finance its dividend payments and its new investments. The assumptions of this model state that the announcements of financial changes such as earnings, dividends, and so on are mutually related, suggesting that both dividend payments and financing are opposing sides of the same topic. They state that the unexpected changes in earnings have the same impact on firm value as the unexpected changes in dividends. Furthermore, the current pattern of dividend payment, not the dividend itself, is the basis of future earnings expectations of the market. Unlike Bhattacharya's (1979) model, in which the transaction costs of issuing new stock is the cost of signalling, Miller and Rock (1985) suggest that the cost of signalling is the cost of foregoing investments, since paying dividends uses the cash that could be used instead for investments. Ambarish et al. (1987) further analyze the signalling model of dividends and argue that the signalling cost can be reduced through an efficient mix of different signal instruments, such as dividends announcements, earnings announcements, share buybacks, investment announcements, and equity issues. According to this model, there is a trade-off between different signalling devices. For instance, the dividend payment should not be used as a signal, since the cost of paying dividends is higher than the cost of earning announcements. Myers (1977) suggests that the announcement of dividend payments is a signal of managers’ expectations about future earnings compared with earnings announcements, and thus the market is more likely to translate dividends announcements, rather than earnings announcements, as an efficient signal.

John and Williams (1985) develop another signalling model in an adverse environment in which dividends are taxable. They indicate that under some conditions – for example, if the current shareholders are selling their holdings to meet personal liquidity needs – the market may value a firm’s shares below its intrinsic value. However, in order to reduce this under-valuation, managers pay larger dividends to their shareholders as a credible signal when other firms, whose future prospects are not as good, cannot imitate the dividend behaviour of undervalued firms. John and Williams (1985) argue that payment of larger dividends is taken as favourable inside information by the market; thus, investors prefer to buy the shares of firms distributing larger dividends at higher share prices. On the other hand, firms with less favourable inside information – i.e., non-dividend-paying firms – should experience negative price reactions. The model proposes that increased shareholder tax costs that arise from receiving higher dividends are offset by the increase in firm value. Allen et al. (2000) contribute to the signalling model of dividends by assuming that institutional investors will choose the stocks of dividend-paying firms because of the tax advantage of dividends. They argue that high-quality firms tend to pay dividends in order to attract institutional investors who are better informed and are more likely to reveal the quality of the firm. On the other hand, low-quality firms avoid paying dividends because they do not like the value of their firm to be revealed by institutional investors. Therefore, dividend policy can help high-quality firms to adjust their ownership structure and improve their information environment.

The signalling role of dividends has been empirically tested mainly by investigating (1) whether dividend change announcements lead share prices to move in the same direction, and (2) whether dividend change announcements allow the market to expect future earnings. These two issues have been studied extensively, but the results have been mixed and inconclusive.

- Dividend announcements and price reactions

Many early studies provide support for the signalling hypothesis that the information content of dividends is reflected in stock price movements, as the announcement of dividend increases (decreases) is associated with significant price increases (decreases). For example, Charest (1978) finds that dividend increases announcements generate excess returns of about 1%. Asquith and Mullins (1983) report a significantly positive excess return on and immediately after the announcement of dividend initiations. Similar results are reported by other studies, including those by Healy and Palepu (1988), who find a two-day excess return of 3.9%, and Michaely et al. (1995), who find a three-day excess return of 3.4%. In a similar vein, Bali (2003) examines the stock price reaction to dividend increases and dividend cuts, and reports an average 1.17% abnormal return following dividend increases and average abnormal return of -5.87% in the periods following dividend cuts, consistent with the predictions of the signalling hypothesis. Brav et al. (2005) survey and interview a large number of executives of US firms and find that 80% of executives believe that the dividend decision conveys information to investors.

However, the significance of dividends as a signalling device seems to vary considerably across markets. For example, Dewenter and Warther (1998) find that the impact of dividends as a signalling means in Japan is significantly lower compared to that of the USA. Dewenter and Warther (1998) conclude that Japanese firms are subject to less information asymmetry compared to US firms, and they attribute these differences to the differences in the structures of corporate governance between Japan and the USA. McCluskey et al. (2006) investigate how the Irish stock market responds to company announcements about dividend payments. They report significant abnormal returns following the announcements of increases or no changes in dividends, and insignificant abnormal returns subsequent to dividend cuts. Positive (negative) reactions to dividend increases (decreases) are reported by Bozos et al. (2011), Dasilas and Leventis (2011), Al-Yahyaee et al. (2011), and Kumar and Raju (2013) in the contexts of the UK, Greek, Omani, and Indian stock markets, respectively.

Nevertheless, some studies provide no support for the signalling hypothesis. For example, Bernhardt et al. (2005) use a sample of US firms that were listed on the NYSE during the period 1962–1996 and show that the information content of dividends is not positively related to the marginal cost of dividends, as suggested by the signalling theory, while the excess returns are more strongly related to the tax regime. An insignificant relationship between dividend announcements and share prices is also found by Ali and Chowdhury (2010), who examine stock price reactions of 25 listed private commercial banks in Bangladesh surrounding 44 days of the dividend announcement dates. They apply the standard Ordinary Least Square (OLS) event study methodology and reveal that stock price reactions to dividend announcement are not statistically significant.

- Dividend announcements and future earnings

Several studies investigate whether dividend changes are reliable signals of the future earnings of a firm. However, no significant evidence has been found. For example, DeAngelo et al. (1996) examine a sample of 145 firms' annual earnings growth and find that there is no significant evidence of dividend signalling for future earnings. Their test focuses on the dividend decision in year zero, which could convey information to outside investors and thereby help the market to predict the earnings. The results show that dividend changes are not helpful in predicting future earnings. Moreover, firms that increase dividends do not exhibit any positive earnings in following years, and that their earnings performance is not better than that of firms that do not change their dividends.

Similarly, Benartzi et al. (1997) and Grullon et al. (2002) find no significant evidence that dividend changes convey information about future earnings. Benartzi et al. (1997) show that earnings increase in the two years following the dividend cut, and that dividend omissions are followed by earnings increases, which is in counter to the signalling hypothesis. Benartzi et al. (1997) also find that firms that increase dividends tend to have a lower decrease in future earnings compared to those that do not. However, they find that dividend changes are strongly related to contemporaneous and lagged earnings changes. Overall, Benartzi et al. (1997) results represent a real challenge to the signalling hypothesis.

Grullon et al. (2002) examine the signalling hypothesis of dividends and find inconsistent results. They use a sample of firms that change their dividends by more than 10%, and show that the level of firms' profitability declines in the years following announcements of dividend increases. However, Nissim and Ziv (2001) provide support for the signalling hypothesis and find that dividend changes are positively correlated with earnings changes over a period of two years following the dividend change while adjusting normal earnings for mean reversion in reported profits. Nevertheless, their results differ for dividend increases vs. decreases. After controlling for current and expected profitability, Nissim and Ziv (2001) find no association between dividend decreases and future profitability, and they assume that this result is due to accounting conservatism.

Grullon et al. (2005) disagree with Nissim and Ziv (2001) in relation to controlling for an incorrect linear form of the mean reversion in earnings, as it can result in a spurious positive correlation between dividend changes and future earnings changes. Therefore, Grullon et al. (2005) adapt Nissim and Ziv's (2001) regression model by incorporating a nonlinear earnings process. Grullon et al. (2005) show that when the partial adjustment model of Fama and French (2000) is used to estimate normal earnings, rather than the mean aversion model used by Nissim and Ziv (2001), dividend payments are not reliable signals of future earnings, showing no support for the information content of dividends about earnings prospects. On the other hand, more recently, applying both Nissim and Ziv's (2001) linear and Grullon et al.'s nonlinear models to the dividend events of UK and US firms, Braggion and Moore (2011) and Liu and Chen (2015), respectively, find strong support for the information content of dividends under both models.

To sum up, many studies test the signalling theory of dividend policy by empirically examining the informational content of dividend changes. Studies on the price reaction to dividend changes provide strong support for the signalling hypothesis, while those on earnings changes following dividend changes provide contradictory evidence to signalling theory.

2.2.3. Agency costs model

In corporations, the two sides engaged in a contract may have different goals and different levels of information. This is called the agent–principal model, and represents the basis of agency models that have been the essence of the corporate finance literature since the pioneering work of Jensen and Meckling (1976), Easterbrook (1984), and Jensen (1986). Jensen and Meckling (1976: 308) describe the agency relationship as “a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent”. The main problem with the agency relationship is the separation of ownership and control, which results in agency costs that are mainly caused by two factors: information asymmetry (the agent tends to have more information) and conflicts of interest between the principal and the agent. In such a relationship, the principal cannot guarantee that the agent is always acting in their best interest, mostly when the actions of the agent are costly for the principal to observe and when the activities that are valuable to the principal are costly for the agent to carry out. To manage these agency costs, a variety of tools may be used, including dividend policy. Several studies suggest that paying dividends can serve as a tool to decrease agency costs that arise from the separation of ownership and control (Rozeff 1982; Easterbrook 1984; Chen et al. 2007b; John et al. 2011).

According to the agency costs model, managers are likely to exploit their superior information and take actions that increase their utilities at the expense of shareholders, resulting in agency costs. Therefore, dividend policy can be used as a mechanism to reduce these agency costs by paying the firm's excess cash to shareholders. Rozeff (1982) argues that the payment of dividends decreases the amount of cash in the hands of managers, which will force them to use external funds to finance the firm’s investment projects. This action is favourable to shareholders since it puts the firm under the additional control of external fund providers. Rozeff (1982) also suggests that the new capital providers will not provide funds unless they get information about the potential use of those funds. Consequently, shareholders may also receive additional information, and, hence, the degree of information asymmetry will be reduced (Howe and Lin 1992).

Furthermore, Easterbrook (1984) claims that dividends can have a crucial role in decreasing agency problems between owners and managers. He argues that the payment of dividends and the subsequent raising of external funds result in monitoring of the firm by capital market participants such as investment banks, financial regulators, and potential investors. This monitoring reduces agency costs and thus increases firm value.

Jensen (1986) free cash flow theory argues that free cash flow can be used to reduce agency costs. Free cash flows are those left in the firm after financing all the investments with positive net present value, and which managers may utilize to invest in non-profitable projects. Jensen suggests that the conflict between shareholders and managers increases in firms with free cash flows. Firms can reduce the free cash flows available to managers, either by paying dividends or increasing the level of debt, and hence obligating the firm to pay debt interest.

Several empirical studies investigate the extent to which agency theory can explain dividend policy. Jensen and Meckling (1976) argue that higher managerial ownership may lead to mitigating the cost associated with the separation between ownership and control. The greater fraction of shares held by managers means that non-value-maximizing actions are unfavourable to managers. Therefore, managerial ownership aligns the interest of both managers and outside investors. Rozeff (1982) was one of the first to test the agency costs theory using a large sample of US firms. He argues that the optimal dividend payout can be achieved once the sum of transaction costs and agency costs are minimized. He uses two proxies for agency costs, namely the percentage of common stock held by insiders and the number of shareholders. He argues that dividend payout ratio should be negatively related to the percentage of stock held by insiders (insider ownership), but positively related to the number of shareholders (dispersion of ownership). Rozeff (1982) provides empirical support for the agency costs hypothesis and shows that the agency costs variables are significantly related to the payout ratio. Dempsey and Laber (1992) replicate the work of Rozeff (1982) and provide consistent findings. Alli et al. (1993) find that the ownership dispersion factor is insignificant related to dividend decision, while the insider ownership variable remains significantly and negatively related to dividend payouts.

Easterbrook (1984) and Stulz (1990) present support for the agency theory by showing that the payment of dividends exposes firms to the possible need to visit capital markets in the future to get external funds, and therefore gives outside investors an opportunity to have some control over insiders. Agrawal and Jayaraman (1994) and Mahadwartha (2007) argue that dividends and managerial ownership can be substitutes, and hence negatively related, if the main reason for paying dividends is to overcome the agency problem. Many empirical studies, including those of Dempsey and Laber (1992), Espen and Verma (1994), and Collins et al. (1996), report a negative association between managerial ownership and dividend payouts. However, Casey and Dickens (2000) replicate the work of Rozeff (1982) on a sample of US firms over the period 1982–1992, and find that insider ownership is not significantly related to dividends. Similarly, Hu and Kumar (2004) show that managerial ownership does not affect dividend payout ratio once firm size is added into the model. Grullon et al. (2002) find that dividend increases tend to be followed by decline in capital expenditures, suggesting that firms that increase dividends reach maturity as they experience a decline in investment opportunity. Al-Malkawi (2007) finds strong evidence to support the agency cost hypothesis in an emerging market. He examines a panel dataset of all public firms listed on the Amman Stock Exchange between 1989 and 2000, and finds that the percentages of stocks held by insiders and state ownership significantly affect the amount of dividends paid. Similarly, La Porta et al. (2000) use a sample of more than 4,000 firms from 33 countries and show that dividends are used as a tool to alleviate the conflict between insiders and outsiders. They find that firms operating in countries where investor protection is typically better make higher dividend payouts than do firms in countries where investor protection is low.

Another strand of studies on the agency costs model of dividends suggests a positive relationship between large shareholder ownership and dividend payments. It is argued that large investors tend to prefer dividends to capital gains because of the tax advantage on dividends. Specifically, low-tax investors are more likely to invest in dividend-paying stocks compared to high-tax investors. Allen et al. (2000) argue that firms pay dividends with the aim of attracting large and well-informed investors (e.g., institutions) who have a lower tax rate and tend to have more ability to control managerial activities. As a result, a higher percentage of institutional shareholding means better monitoring of management, which reduces agency costs and increases firm value (Chang et al. 2016). Espen and Verma (1994) show a significant positive effect of both institutional shareholders and managers ownerships on dividend policy. Moreover, using a sample of UK firms covering the period from 1988 to 1992, Short et al. (2002) show a significant positive relationship between dividend policy and institutional ownership. Hotchkiss and Lawrence (2007) find that the percentage of shares owned by institutional investors increases as dividends increase. Similarly, Crane et al. (2016) suggest that higher overall institutional ownership causes firms to pay more dividends.

However, Hu and Kumar (2004) find that the probability of paying dividends and dividend yields are negatively related to the percentage of shares owned by the largest outside shareholders. Jain (2007) also presents evidence that institutional investors are more likely to hold non-dividend-paying stocks or low-dividend-paying stocks, whereas non-institutional investors tend to hold high-dividend-paying stocks. Karpavicius and Yu (2012) examine the impact of institutional ownership on dividends and show that an increase (decrease) in institutional ownership results in a lower (higher) dividend yield. Firth et al. (2016) find that institutional investors, such as banks, insurance companies, and securities companies do not have any effect on firms' cash dividend payments.

In brief, the separation of management from ownership leads to agency costs including asymmetric information and conflicts of interest between managers and shareholders. These agency costs can be decreased through dividend policy, which can serve as a way of monitoring and controlling managers' performance. By increasing cash dividends, the firm can be forced to use external funding. Such an action causes managers to be under the monitoring of the capital market, and this capital market monitoring can decrease agency costs and lead to an increase in the market value of the firm. In addition, the increasing cash dividends lead to a withdrawal of cash from the control of managers, which reduces the likelihood of misuse of funds by investing in negative net present value projects, which may affect shareholders' wealth. If the firm has not paid dividends, this will open the door for its managers to adopt policies that may not be in the stockholders' interest (DeAngelo et al. 2004).

2.2.4. Clientele effect theory

Shareholders face different tax treatments for dividend income and capital gains, which may create shareholders clienteles. These clienteles will be attracted to firms which follow dividend policies that best match their preferences. For example, investors in low tax brackets who depend on fixed income are more likely to be attracted to firms that pay high dividends. Additionally, institutional investors tend to be attracted to high-dividend stocks (see, e.g., Han et al. 1999; Dhaliwal et al. 1999; Short et al. 2002). However, investors in relatively high tax brackets might find it valuable to invest in firms that keep most of their income in order to obtain potential capital gains.

Allen et al. (2000) argue that clienteles consisting of institutional investors tend to be attracted to dividend-paying firms due to their relative tax advantages over individual investors. Similarly, high-quality firms have a preference to attract institutional clienteles (through paying dividends) because institutions are better informed than retail investors, and have more ability to monitor or detect firm quality.

A large body of empirical research examines the clientele effects of dividend policy. Elton and Gruber (1970) examine the share price movement around the ex-dividend day and find that share prices fall by less than the amount of the dividend on ex-dividend days. They argue that tax differences induce a preference for capital gains compared to dividends, which supports the tax clientele hypothesis that investors in high (low) tax brackets invest in low- (high-) dividend-yield stocks. Pettit (1977) also shows that investor age has a significant positive relationship with portfolios' dividend yield, but investors' income has a negative relationship with dividend yield. He argues that elderly, low-income investors are more likely to invest in high-dividend stocks because they depend more on their portfolios to finance their current consumption, and avoid the transaction costs associated with selling stocks. Dhaliwal et al. (1999) test the changes in institutional shareholdings after dividend initiations. They use a sample of 133 dividend-initiating firms from 1982 to 1995 and show that 80% of the sample firms experience a significant increase in institutional shareholders after dividend initiation. They argue that their results are driven by the strong influence of the tax-clientele effect on investors' decisions. Graham and Kumar (2006) investigate the stock holdings and trading behaviour of more than 60,000 households. They find that retail investor stock holdings indicate a preference for dividend yield that increases with age and decreases with income. They also find that older, low-income investors disproportionally purchase stocks before the ex-dividend day. Furthermore, among small stocks, the reduction in ex-day price decreases with age and increases with income, consistent with clientele effects. Brav et al. (2005) document that financial executives tend to be hesitant in making big changes to payout policy, as such changes might modify a firm's investor base and adversely impact its stock price.

Grinstein and Michaely (2005) and Hotchkiss and Lawrence (2007) find that institutions overweight their portfolios with dividend-paying stocks. Hotchkiss and Lawrence (2007) find that institutional investors appear to have different "dividend clienteles" as some institutions steadily hold stocks with high dividends. Once firms declare changes in their dividend policy, dividend increases (decreases) are associated with increased (decreased) holdings by institutions that seem to have a preference to dividends based on their prior portfolio. Desai and Jin (2011) analyze a panel of firms matched with the tax characteristics of their institutional shareholders and find that "dividend-averse" institutions have significantly low tendency to hold shares in firms with larger dividend payouts. This relation between the firm payout policy and the tax preferences of institutional shareholders may indicate that dividend-averse institutions are attracted to low-dividend-paying firms, or managers adjusting their payout policies to the interests of their institutional shareholders. Recently, Dahlquist et al. (2014) found that investment funds that face a higher effective tax rate on dividend income than on capital gains tilt their portfolios away from dividend-paying stocks.

2.2.5. The life cycle theory

The life cycle theory was first proposed by Mueller (1972). It states that each firm has its own life cycle. The start-up stage tends to be difficult for new firms, in which the limited resources have to be invested in product development and marketing. Following the start-up stage, the firm will enter into a high-growth stage in which its customer base increases, as well as its market potentials. After the growth stage, firms will reach a maturity stage during which the growth rate declines and the investment opportunities decrease.

The characteristics of firms differ over their life cycle, and dividend policies at different stages are correspondingly adjusted by managers. In the early stages, a new firm tends to have many growth opportunities, but its profitability is rather low and unstable. Moreover, the information asymmetry level of new firms is often high, and thus their cost of capital tends to be relatively high. Therefore, it might be best for a new firm to retain its earnings, rather than distribute them to shareholders. However, when the firm reaches the maturity stage, its investment opportunities begin to decrease, such that its growth rate and systematic risk decline. Nevertheless, mature firms are commonly associated with high earnings, and are therefore more likely to distribute cash dividends to shareholders.

The life cycle explanation of dividends has also been extensively tested in the literature (see, e.g., Fama and French 2001; Grullon et al. 2002; DeAngelo et al. 2006). Fama and French (2001) analyze the dividend policies of US firms and suggest that the decline in the percentage of dividend-paying firms is to some extent a result of the increasing number of small, low-profit, and high-growth firms. This is in line with the life cycle theory that firms in the start-up stage are reluctant to distribute dividends. Based on the differences between high-growth firms and mature firms, Grullon et al. (2002) provide evidence that the systematic risk declines (increases) following dividend increases (decreases). Using a large sample of 7,642 dividend change announcements between 1967 and 1993, they find that the increase in stock prices after dividend increase is an indication that investors recognize dividend-increasing firms as those with lower systematic risk. Following these findings, Grullon et al. (2002) propose the maturity hypothesis, which posits that a firm tends to increase dividends as it moves to a more mature phase, during which its investment opportunities decline, leading to an increase in the firm’s free cash flows. A mature firm then pays out these free cash flows in the form of dividends. Consistent with the results of Grullon et al. (2002), Eije et al. (2014) examine the influence on firm risks of a sample of US firms that initiate or omit dividends over the period 1972–2012. They find that firms’ aggregate systematic risk, measured as the aggregation of the three risk factors posited by Fama and French (1993), significantly declines (increases) after cash dividend initiations (omissions), which supports the life cycle maturity hypothesis.

DeAngelo et al. (2006) provide further support for the life cycle theory of dividend policy by using a mix of earned/contributed capital as a measure for the maturity of a firm. They find a significant relationship between the decision to pay dividends and the earned/contributed capital mix after controlling for profitability, growth, firm size, total equity, cash balances, and dividend history. Moreover, they show that this relationship holds for both the initiations and omissions of dividends. Similarly, Denis and Osobov (2008) test the dividend policy of firms at an international level involving six economies: US, UK, Japan, Canada, Germany, and France. They find that the decline in the tendency to pay dividends is strongly explained by the mix of earned/contributed capital. Coulton and Ruddock (2011) examine whether the life cycle theory explains the variation in payouts of Australian firms, and find strong evidence that the probability that a firm pays dividends increases in proportion with the retained earnings of its capital structure. Firms with a relatively low proportion of retained earnings are likely to be in growth or capital-infusion stages, while firms with a high proportion of retained earnings are likely to be more mature, and can generate cash but have fewer growth opportunities, and are therefore good candidates to pay dividends. More recently, Banyi and Kahle (2014) examine the life cycle theory of dividends and find a positive relation between earned/contributed capital and the fraction of US firms that pay dividends.

In summary, the life cycle theory argues that changes in dividends is an indication of the changes in growth opportunity and free cash flows (Fama and French 2001; Grullon et al. 2002; DeAngelo et al. 2006). In the early stages of their life cycles, firms are more likely to reinvest in profitable projects, rather than distribute dividend payments. However, as firms reach matures stages in terms of profitability and growth opportunities, they tend to pay dividends. Generally, the empirical evidence is in line with the predictions of the firm life cycle theory of dividends.

2.2.6. Summary of the dividend policy literature

The extant finance literature has put a great deal of effort into understanding dividend policies, and this has led to the development of several theories. However, after several decades of investigation, no general consensus has arisen, and dividend policy remains a puzzle. In the perfect capital market outlined by Miller and Modigliani (1961), the value of a firm is independent of its dividend policy. However, various market imperfections exist, including information asymmetry, and this source of market imperfection has provided the basis for the development of various models of dividend policy, including signalling and agency models. The main argument of these models is that the different market participants (investors and managers) tend to have distinct information about the firm’s future prospects. With regard to the signalling model, dividend policy is used as tool to convey information about the firm’s performance to the market. In the agency model, on the other hand, the dividend policy is used as a tool to reduce the information costs associated with the separation of management and control. In both models, any changes in dividend policy will affect the information gap between the market participants; hence, the market value of the firm will be affected.

2.3. Stock liquidity

Liquidity is a key characteristic of financial markets. It is a multi-dimensional phenomenon that reflects different interdependent dimensions, such as frequency of trade, volume of trading, and market depth (Sarr et al. 2002; Liu 2006). Previous literature focuses on the liquidity of individual stock and the impact on its return (see, e.g., Amihud and Mendelson 1986; Eleswarapu 1997; Chalmers and Kadlec 1998; Datar et al. 1998). However, in the last decade, aggregate market liquidity has been the focus of many researchers (Chordia et al. 2000; Pástor and Stambaugh 2003; Liu 2006). Given its importance for the functioning of the financial markets and for the economy as a whole, the behaviour and determinants of stock liquidity have been the main concern for investors, businesses, financial regulators, and policy makers.

Understanding the determinants and possible effects of stock liquidity is important for several reasons. First, liquidity is a main function of the market, as investors who enter the market either supply or demand liquidity. Second, market liquidity is an important factor influencing both the individual stock return and the aggregate market return. Third, changes in market liquidity could lead to financial crises. A recent study by Næs et al. (2011) regarding the most recent financial crises shows that the decrease in stock market liquidity is a sign of crisis in the real economy.

2.3.1. Liquidity definitions and dimensions

Over the years, while several definitions have been developed for liquidity, there is no consensus on a single one. The majority of previous studies define liquidity according to its dimensions or characteristics. Harris (2003) refers to liquidity as the ability to trade in large quantity at low cost. According to Nahandi et al. (2012: 4956), liquidity of a security is "the possibility of selling it fast. The faster you can sell a security with low cost, the more capability of liquidity it is claimed to have. The securities being transacted daily and repetitively have more liquidity and lower risk." Aitken and Comerton-Forde (2003) define liquidity as the ability to exchange securities into cash at the lowest cost. For Liu (2006), liquidity is the ability to trade large quantities quickly at low cost, with less price impact. Accordingly, liquidity is presented in three dimensions: time, price, and quantity.

In spite of the ambiguous concept of stock liquidity, most of the liquidity literature defines it through its different dimensions. Kyle (1985) associates liquidity with four interdependent dimensions, as follows:

1. ***Trading Time or Immediacy:*** This is the time needed to execute a transaction. The shorter the time required to trade a stock, the more liquid that stock is. Massimb and Phelps (1994: 41) define liquidity as the "market's ability to provide immediate execution for an incoming market order (often called 'immediacy')". The most common measures for trading time are the waiting time between subsequent trades or the inverse and the number of trades per time unit.

2. ***Width or Tightness:*** This is the ability to trade immediately, without a large change in price (i.e. tightness shows the cost associated with trading, or the cost of immediacy). Kyle (1985: 1316) refers to tightness as "the cost of turning over position in a short period of time". The common measures for tightness are the different versions of the spread (see, e.g., Engle and Lange 2001; Hasbrouck 2003).

3. ***Depth:*** This represents the volume that can be traded by an investor without significant changes in prices. Kyle (1985: 1330) defines depth as "the ability of the market to absorb quantities without having a large effect on price". There are many measures of depth, including the

number of shares traded, the number of transactions, and the different volume measures.

4. ***Resiliency:*** This is the ability to buy or sell a certain amount of an asset with little influence on the quoted price. According to Harris (2003), it refers to how quickly prices return to original levels following changes in response to large trading. For Kyle (1985), resiliency is the speed with which prices tend to be corrected in the market. Resiliency can be measured by the market reaction curve, which is defined by Engle and Lange (2001: 115) as "the schedule of the hypothetical transaction price to be expected for various-size buying or selling orders".

2.3.2. Stock liquidity measures

Stock liquidity is difficult to define, and more difficult to measure, by its very nature (Lesmond 2005; Korajczyk and Sadka 2008). Recently, a large amount of literature has dealt in different ways with stock liquidity. However, existing studies have not yet reached consensus on how liquidity is defined and measured. Fernandez (1999) argues that there is a lack of knowledge of how liquidity can be measured and how liquidity risk can be integrated into the risk-management process. Therefore, he addresses the importance of using different liquidity measures to reflect the different aspects of liquidity. Moreover, Aitken and Winn (1997) indicate that studies on stock market liquidity use around 68 proxies, but fail to find an agreement on the best one to use. Sarr and Lybek (2002) divide liquidity measures into four groups: (1) transaction cost measures that reflect stock tightness; (2) volume-based measures to capture depth and breadth; (3) price-based measures to reflect resiliency; and (4) market-impact measures to capture resiliency and speed of price adjustment.

Given the multidimensional nature of liquidity, liquidity measures can be categorized into one-dimensional and multi-dimensional measures. The one-dimensional liquidity measures, such as bid–ask spread measures, depth measures, and volume measures, consider only one aspect of liquidity and time measures, whereas the multi-dimensional liquidity measures, including the quote slope, composite liquidity, liquidity ratio, and Amihud (2002) illiquidity ratio, aim to capture various aspects in one measure. The following sections provide a summary of the main liquidity measures used in the literature.

2.3.2.1. One-dimensional liquidity measures

One-dimensional liquidity measures can be divided into two main sets: trading cost measures, which address the tightness of stock liquidity, and trading activity measures, which capture the depth and breadth of stock liquidity.

- **Trading cost measures**

The costs of trading measures capture the tightness aspect of stock liquidity. Trading cost is a decreasing function of stock liquidity. The trading costs are widely measured by bid–ask spread measures, which represent the most commonly used measures of liquidity, and have been used extensively in various research areas. The bid–ask spread measure gives an approximation of the cost incurred when trading, and is measured as the difference between the ask and the bid price. The smaller the spread measures, the more liquid the market is. The most commonly used measures of bid–ask spread are discussed below:

Absolute/quoted spread ($Sabs$)

This measure is the difference between the lowest ask price and the highest bid price, and is always positive. It is calculated as follows:

$$Sabs_t = p_t^A - p_t^B$$

where p_t^A is the best ask price at time *t* and p_t^B is the best bid price at time *t*. The higher the $Sabs_t$, the higher the trading cost and the lower the stock liquidity. This measure is widely used in the liquidity literature (Chordia et al. 2000; Hasbrouck and Seppi 2001).

Relative/proportional quoted spread ($Spro$)

This measure is the ratio of the absolute bid–ask spread to the average of the bid price and ask price, and can be found by:

$$Spro_t = \frac{p_t^A - p_t^B}{p_t^M} = \frac{2(p_t^A - p_t^B)}{p_t^A + p_t^B}$$

where p_t^M indicates the mid-price, which equals $\frac{p_t^A + p_t^B}{2}$. The first to use this spread measure was Amihud and Mendelson (1986). Using 49 stock portfolios from the NYSE over 1961–1980, Amihud and Mendelson (1986) provide empirical evidence that investors require a higher rate of return as compensation for trading cost, which is measured by the bid–ask spread. Using the same sample, but over a different period (1973–1990), Eleswarapu (1997) supports the results of Amihud and Mendelson (1986). The relative spread is easy to calculate and can make the liquidity of different stocks comparable to each other. Moreover, it can be calculated even if no trade takes place (Brennan et al. 1998; Jones 2002). On the other hand, many studies criticize the proportional spread. For instance, Brennan and Subrahmanyam (1996) state that the true execution price is not reflected in the proportional spread, since several large trades take place outside the quote and many small trades take place inside it. Therefore, many studies now use effective spread as a proxy for liquidity.

Effective spread ($Seff$)

Effective spread is the ratio of the absolute difference between the traded price and the midpoint of the best bid and ask price, to the midpoint. It can be computed as:

$$Seff_t = \frac{|p_t - p_t^M|}{p_t^M}$$

where p_t indicates the last traded price before time *t* and the mid-price, p_t^M, is computed as above. The effective spread has an advantage over absolute spread in that it is not limited to the inside quotes.

- **Trading activity measures**

Trading activity measures capture the depth aspect of stock liquidity. The higher the trading activity, the higher is the stock liquidity. The most widely used proxies for measuring the trading activity are discussed below:

Trading volume (Q)

Trading volume is defined as the number of traded shares, which is given by:

$$Q_t = \sum_{i=1}^{N_t} q_i$$

where N_t indicates the number of trades in time t, and q_i is the number of shares traded at trade i. A higher trading volume implies higher stock liquidity. Trading volume (Q_t) has been used in a number of liquidity-related studies; for example, Chordia et al. (2000), Elyasiani et al. (2000), and Hasbrouck and Seppi (2001).

Dollar volume (V)

It refers to the dollar value of traded shares, which is calculated as:

$$V_t = \sum_{i=1}^{N_t} p_i * q_i$$

where N denotes the number of trades, p_i and $q_i$denote the price and quantity of traded shares at the ith trade. Many studies use dollar volume as a proxy for liquidity; for example, Chordia et al. (2000) and Pástor and Stambaugh (2003).

Turnover ratio (TO)

It is the ratio of the number of traded shares to the number of issued shares, and can be calculated for a specific time interval as follows:

$$TO_t = \frac{\sum_{i=1}^{N_t} q_i}{NO_t}$$

where q_i denotes the number of shares traded at the ith trade, N_t is the number of trades and NO_t is the number of shares outstanding. Like the trading volume, turnover ratio is frequently used. For example, Darrat et al. (2007) show that the volatility of the stock is positively related to the number of shares traded. In the field of assets pricing, Chordia et al. (2000) find a negative relationship between stock return and stock turnover.

The data required to calculate volume measures are available for most markets, which makes them easy to calculate. However, Aitken and Comerton-Forde (2003) argue that volume measures reflect past trading activity. Volume measures have been used widely in the literature.

Quoted depth (D)

This measure reflects the sum of the quantity volume available at the best bid and ask price, and can be calculated as:

$$D_t = q_t^A + q_t^B$$

where q_t^A and q_t^B refer to the best bid and the best ask quantity volume in the order book. D_t also refers to as "quantity depth" (Huberman and Halka (2001) can be divided by two and, hence, modified to an average depth of the bid and the ask depth, similar to Chordia et al. (2000) and Goldstein and Kavajecz (2000).

Quoted dollar depth ($D\$$)

It is usually calculated as the average of the number of shares at the best bid price times its price, and the number of shares at the best ask price times its price.

$$D\$_t = \frac{q_t^A * p_t^A + q_t^B * p_t^B}{2}$$

where p_t^A refers to best ask price at time t and p_t^B to the best bid price at time t. The dollar depth has the advantage of making the liquidity of different stocks comparable to each other.

Depth measures have been widely used in the liquidity literature. In Chordia et al. (2005), dollar depth is used as a proxy for liquidity to examine the relationship between liquidity spillovers and stock returns. Researchers who study the effect of ownership structure on market liquidity find a negative relationship between the fractional ownership of insiders and institutions and the quoted depth; for example, Rubin (2007) and Chung et al. (2010). The higher the depth measure, the more liquid is the market.

Waiting time (WT)

It also refers to as number of transactions per time unit and can be given by:

$$WT_{it} = \frac{1}{N-1}\sum_{i=2}^{N}(t_i - t_{i-1})$$

where t_i denotes the time of a trade, t_{i-1} the time of the previous trade, and N the number of trades between time t and time $t-1$. Many researchers use the number of transactions as a proxy for liquidity, including Dufour and Engle (2000), who provide evidence that the shorter the time between trades, the higher the stock price volatility and return.

2.3.2.2. Multi-dimensional liquidity measures

The measures discussed above are based on capturing a single aspect of stock liquidity. In the following, we discuss the most commonly used measures that reflect the multi-dimensional nature of stock liquidity. Multi-dimensional liquidity measures reflect the properties of more than a one-dimensional liquidity measure, and hence reflect both the price and quantity aspects of stock liquidity. The majority of these measures focus on the price impact.

Amivest/liquidity ratio (LR)

Amihud et al. (1997) develop this liquidity proxy which combines both the quantity and cost aspects of stock liquidity. The liquidity ratio captures the trading volume associated with a unit change in the stock price.

$$LR_t = \frac{V_t}{|r_t|}$$

where r_{it} denotes the return at time t, and V_t is the dollar volume at time t. The liquidity ratio reflects the price impact of a trade by measuring the traded volume that causes price to change by 1% during a certain period. The higher the trading volume absorbed without a significant change in price, the higher the liquidity ratio, and hence the higher the stock liquidity. This measure is used in various research areas; for instance, Elyasiani et al. (2000) use the liquidity ratio to examine the impact of stock movements from NASDAQ to NYSE or AMEX on their liquidity. In another field, Becker-Blease and Paul (2006) apply liquidity ratio to study the impact of stock liquidity on investment decisions, and show that liquidity improves as capital expenditures increase.

Zeros

Lesmond et al. (1999) develop this liquidity measure which is defined as the number of days with zero daily return during a year for a certain stock (*zeros*).

$$Zeros = \frac{(number\ of\ days\ with\ zero\ returns)}{T}$$

where *T* is the number of trading days in a month. This measure is based on the models of Kyle (1985) and Glosten and Milgrom (1985), who argue that informed investors will trade only if the value of the informational signal is large enough to cover transaction cost. If the value of the information signal is not sufficient to exceed the transaction cost, this investor will either trade less or not trade, incurring a zero return. Lesmond et al. (1999) state two main advantages for this measure. First, it is easy to calculate since it needs only the time series of daily returns, which are available and easy to obtain. Second, this measure implicitly reflects all transaction costs, as it is based on the investor decision to trade, which in turn depends on the transaction costs. However, it has several limitations, including the fact that zero returns do not always indicate non-trading, but can result from uninformed trading or lack of information (Bekaert et al. 2007). Moreover, some trades (such as index trades) do not give rise to price changes.

Flow ratio (FR)

This measure is introduced by Ranaldo (2001). It captures the resiliency aspect of stock liquidity, and combines the quantity and time aspects of liquidity. It is calculated as the dollar volume divided by the waiting time. Accordingly, it measures if trading takes place in few but large transactions, or in lots of small trades. The higher the flow ratio, the higher is the liquidity.

$$FR_t = \frac{V_t}{WT_t} = \frac{\sum_{i=1}^{N_t} p_i * q_i}{\frac{1}{N-1}\sum_{i=2}^{N_t}(t_i - t_{i-1})}$$

where V_t is the dollar volume traded in time t and WT_t is number of transactions between time t and time $t-1$.

Order ratio (QR)

It is another liquidity measure introduced by Ranaldo (2001) and can be calculated as:

$$QR_t = \frac{|q_t^B - q_t^A|}{V_t} = \frac{|q_t^B - q_t^A|}{p_t * q_t}$$

The order ratio defines as the order imbalance value $(|q_t^B - q_t^A|)$ divided by the dollar volume (V_t). It compares depth measured as market imbalance to trading volume. A high (low) order ratio indicates low (high) liquidity.

Illiquidity ratio $(IlliqR)$

Amihud (2002) introduces this measure that is he related to the Amivest liquidity ratio. According to Amihud (2002), this measure reflects Kyle's (1985) concept of illiquidity, which is the price response of order flow, and is the percentage change in price resulting from one-dollar trading. Amihud (2002) refers to illiquidity ratio as the absolute stock return divided by the dollar volume. The lower the illiquidity ratio, the higher is the stock liquidity.

$$IlliqR_t = \frac{|r_t|}{V_t}$$

where, r_t is the return in time t, V_t is the dollar volume in time t. Because it is easy to calculate, illiquidity ratio has been used by several researchers. In the area of liquidity and asset pricing, Nguyen et al. (2007) apply the illiquidity ratio as a measure of liquidity. Acharya et al. (2013) use the illiquidity ratio as a proxy for liquidity to study the effect of liquidity shocks of stocks and treasury bonds on US corporate bond returns over the period 1973–2007. Edmans et al. (2013) use the illiquidity ratio and show a positive effect of stock liquidity on block-holder governance. Goyenko et al. (2009) and Hasbrouck (2009) point out the high performance of this measure relative to other measures in capturing the transaction costs using US data.

LMx

Liu (2006) establishes this new liquidity measure which is based on the definition of liquidity as the ability to trade large quantities quickly at low cost with less price impact.

$$LMx = \left(number\ of\ zero\ daily\ volumes\ in\ prior\ x\ months + \frac{\frac{1}{(x\_month\ turnover)}}{deflator} \right) * \frac{21x}{NoTD}$$

where LMx is the degree of illiquidity for month x; $x\_month\ turnover$ is the turnover over the prior x months, measured by the sum of daily turnover over the prior x months, and $NoTD$ is the total number of trading days in the market over the prior x months. The number of zero daily volumes in the prior x months reflects the intuition that the absence of trading in a security specifies its level of illiquidity.

This liquidity measure captures various aspects of liquidity, for example trading speed, trading quantity, and trading cost. Particularly, the number of zero daily volumes over the prior x months reflects the continuity of trading and the potential delay in executing an order. The adjustment for turnover captures the trading quantity aspect of liquidity. The link between zero volumes and number of trades can also capture the aspect of trading cost.

2.3.2.3. Other liquidity measures

Some researchers employ a set of liquidity measures that differ from those mentioned above. For example, Chordia et al. (2001) present a liquidity measure called *composite liquidity* ($Composite\ Liq$), which combines depth and trading cost dimensions and is calculated as follows:

$$Composite\ liq = \frac{\%\ Quoted\ spread}{Dollar\ depth}$$

Composite liquidity is calculated by using the relative bid-ask spread $\frac{p_t^A - p_t^B}{p_t^M}$ in the numerator divided by the dollar depth $\frac{q_t^A * p_t^A + q_t^B * p_t^B}{2}$. A high relative bid-ask spread with low dollar depth implies high composite liquidity which denotes low liquidity.

Another liquidity measure is *market impact* (MI). The spread measures take into account only the price dimension, ignoring the volume dimension of liquidity. However, the market impact measure tries to overcome this problem by capturing both trading costs and volume. It is referred to as the spread of a specific trading volume, and is calculated as follows:

$$MI_t^{V*} = P_t^{A,V*} - P_t^{B,V*}$$

where $P_t^{A,V*}$ is the ask price at time t for a certain volume and $P_t^{B,V*}$ is the bid price at time t for a certain volume.

Depth for price impact (DI) is a liquidity proxy that combines the trading volume and cost aspects of liquidity. It is the number of shares traded that result in a movement in price by a certain amount of K ticks away from the quote midpoint. The ask-side price impact depth is calculated as follows:

$$DI^A\ (K) = Q_k^A$$

where Q_k^A is the sum of shares sold at K different ask prices. This measure can be calculated for the bid side of the market as well. The greater the depth for the price impact measure, the more liquid the market.

Holden (2009) develops a proxy of the effective spread based on observable price clustering *(effective tick)*. This measure is based on the notion that trade prices are clustered in order to minimize negotiation costs between potential traders. Effective tick can be calculated as the ratio of the probability weighted average of each effective spread size to the average price in time interval *i* ($\bar{P}_t$), as follows:

$$Effective\ tick = \left(\frac{\sum_{j=1}^{J} \hat{\gamma}_j s_j}{\bar{P}_t}\right)$$

where $\bar{P}_t$ is the average trade price over the time period of aggregation, $\hat{\gamma}_j$ is the constrained probability of the j^{th} spread and s_j is the realization of the effective spread at the closing trade of the day which is randomly drawn from a set of possible spreads (s_j). The higher the effective tick, the lower is the stock liquidity.

Goyenko et al. (2009) propose five liquidity measures computed from two major databases: high-frequency Trade and Quote (TAQ)[9] and Rule 605[10]. *Effective spread (TAQ)* is the first measure, which is calculated as follows:

$$Effective\ spread\ (TAQ)_k = 2|\ln(P_k) - \ln\ (M_k)|$$

where $\mathrm{P_k}$ is the price of the K^{th} and M_k is the midpoint of the best bid offers (BBO)[11] existing at the time of the K^{th} trade. It is computed from the TAQ database and equals the dollar-volume-weighted average of *effective spread (TAQ)k* calculated over all trades in a time interval.

The *realized spread* $(TAQ)_K$ is the second liquidity measure. It is the temporary component of the effective spread. The *$effective spread (605)* is the third liquidity measure and is calculated from the Rule 605 database. It refers to the ratio of share-volume-weighted average of *$effective spread* $(605)_k$ computed from overall market to the average price in a certain month. The fourth liquidity measure is the *static price impact (605),* which is the cost of demanding additional immediate liquidity and can be seen as the first derivative of the effective spread with regard to order size. The fifth liquidity measure is the *five-minute price impact* $(TAQ)_k$, which measures the derivative of the cost of demanding a certain amount of liquidity over five minutes, and differs from the curve for demanding the same amount of liquidity immediately.

[9] The TAQ database is a collection of intraday trades and quotes for all securities listed on the NYSE, American Stock Exchange, Nasdaq National Market System and SmallCap issues (see http://www.kellogg.northwestern.edu/rs/data/dstest.aspx?DB=taq-database).
[10] The Securities and Exchange Commission adopted Rule 605 on 15 November 2000, and aims to improve public disclosure of order execution quality. The Rule requires all exchanges and other market centres to make detailed monthly public disclosure of execution quality (see http://www.finra.org/industry/sec-rule-605).
[11] BBO stands for the best bid and offer. It is the highest bid price and lowest ask price available for a given stock at a specific moment in time.

2.3.2.4. Comparison of measures

The list of liquidity measures discussed above is long, but far from complete. The most important insight from discussing these measures is that liquidity is not a one-dimensional variable, and therefore is difficult to capture using a single measure; indeed, according to Amihud (2002), it is doubtful whether there is one single measure that captures all aspects of liquidity. However, one-dimensional measures may provide insight into certain questions of stock liquidity that multi-dimensional measures may be unable to provide.

The relative performance of the most commonly used liquidity measures has been assessed extensively. However, mixed and contradictory results have been shown. Petersen and Fialkowski (1994) compare between effective bid–ask spread and posted bid–ask spread and find a significant difference between them.[12] More specifically, they find that the effective spread averages half the posted spread, and that effective spread is significantly smaller than posted spread. Moreover, Petersen and Fialkowski (1994) find that the correlation between the effective spread and the posted spread is less than 0.1. They claim that this low correlation implies that empirical evidence from studies employing the posted spread may be misleading. Therefore, they see the posted spread as a poor measure of liquidity.

Hasbrouck (2009) compares four measures – namely TAQ, Amihud (2002) illiquidity ratio, Gibbs, and Zeros – to effective spread and price impact that are calculated from TAQ data over the period 1993–2003. He shows that Amihud (2002) illiquidity ratio dominates as a measure for price impact and Gibbs dominates as a measure for effective spread. In a recent study, Goyenko et al. (2009) compare the most widely used liquidity measures, including many bid–ask spread proxies and price impact proxies. They document a close association between many of these proxies. In addition, they show that the widely used Amihud (2002) illiquidity ratio is a good measure for price impact. Goyenko et al. (2009) also find that liquidity

[12] According to Petersen and Fialkowski (1994), the posted spread is the minimum ask price minus the maximum bid price and the effective spread is the posted spread minus twice the expected price improvement in the subsample. Price improvement is defined as minimum (ask price) minus transaction price for buy orders, or transaction price minus maximum (bid price) for sell orders.

measures derived from daily data are good measures of high-frequency transaction cost benchmarks. Moreover, in monthly and annual comparisons of effective and realized spreads, they find that the best measures are effective spread, effective tick, and Zeros.

2.4. Conclusion

This chapter briefly reviews some literature relating to dividend policy and stock liquidity. It explains how the dividend irrelevance theory of Modigliani and Miller (1961) has inspired researchers to study, both theoretically and empirically, the importance of dividend policy to corporations and investors, and consequences related to the stock market. Miller and Modigliani (1961) argue that firm value is independent of dividend policy under assumptions of perfect capital markets. Much of the research done on dividend policy examines its impact on firm value when certain assumptions of perfect capital market are relaxed. In general, the evidence is mixed for all of the major dividend theories. The evidence on taxes seems to point to the existence of dividend clienteles, but there is little support that they actually affect firm value. There also seems to be mixed support for the role of agency theory in explaining firms' dividend policies. Finally, the long-held notion that dividend increases signal managements' beliefs of higher future cash flows has recently been under attack.

While the dividend theories seem to have some validity, tests of the theories appear to be noisy, and sensitive to the sample design and the variables used. Moreover, the majority of empirical studies that test dividend theories imply that dividends can affect firm value by focusing on the valuation effects of dividends through investigating changes in stock market price. However, dividends could potentially affect firm value by affecting the external characteristics of the firm's stock; e.g., by changing the information environment, and hence the liquidity of the stock. The changes in stock market liquidity have several implications on corporate financial policies (Amihud and Mendelson 1986). This thesis adds to the existing dividend literature by investigating stock liquidity as a potential channel through which dividends affect firm value.

This chapter also discusses the concept of stock liquidity, and its dimensions and measures. Although stock liquidity is a broad and elusive notion, it can be defined by four main dimensions, which are immediacy, tightness, depth, and resiliency. Immediacy is defined as the speed with which orders can be executed. Tightness refers to small bid–ask spreads which produce low transaction costs. Depth refers to the presence of large orders below and above the price. Resiliency arises in a market in which new order arrivals flow quickly to adjust order imbalances, which lead prices to move away from their true value. The literature on stock liquidity has applied a large number of measures to capture its dimensions. These measures can be categorized into either one-dimensional or multi-dimensional. However, the empirical studies show that each measure has different strengths and limitations.

Chapter 3: Dividend Policy and Stock Liquidity

3.1. Introduction

Liquidity is one of the key characteristics of securities markets that investors observe when making investment decisions and analysing securities. It is important because it has a direct impact on transaction costs and shareholders' required rate of return, which in turn affects the firm's value. Amihud and Mendelson (1986) suggest that since liquidity can increase firm value, firms are more likely to follow a corporate policy that makes their stocks more liquid (Amihud and Mendelson 2012). Moreover, Baker and Pettit (1982), Wan (2001), and Bilinski et al. (2012) show that firm's managers exhibit more care about the liquidity of the firm's stock because any increase in liquidity reduces transaction costs and increases firm value. Since stock liquidity has critical implications for several finance areas, including asset pricing, stock market performance, and, most importantly, corporate policies,[13] many researchers have studied issues of stock liquidity. Because of its importance, examining liquidity effects of particular corporate decisions, such as dividend policy decisions, is vital.

Some of the key decisions of firms' management are dividend policy decisions. Firm managers should be careful when making the decision regarding whether to pay dividends, as well as the amount of dividends. Early literature on dividend policy focuses mostly on the reasons for paying dividends (Alli et al. 1993; DeAngelo et al. 2006; Denis and Osobov 2008), the information content of dividend announcements (Miller and Rock 1985; Amihud and Li 2006), and the valuation effects associated with dividend announcements (Al-Yahyaee et al. 2011; Bozos et al. 2011; Dasilas and Leventis 2011). Companies choose to pay dividends with the ultimate goal of enhancing their stock valuation (Baker 2009). Dividend policy has been studied extensively by researchers to measure the financial impact on a firm's share market price (e.g., Asquith and Mullins 1983; Abeyratna et al.

[13] See Amihud and Mendelson (2012) for detailed discussions of the implications of stock liquidity.

1996; Marsh and Power 1999; McCluskey et al. 2006; Dasilas and Leventis 2011) and consequently the extent of its contribution to achieve management's target, namely maximizing the market value of shares and thus maximizing the owners' wealth.

However, there are other possible sources of the gains in shareholders wealth associated with dividend policy, such as changes in the quality of the stock's trading environment and, as a result, an improvement in the stock's liquidity. Firms can improve their stock market liquidity by adopting corporate policies that mitigate informational asymmetries between firms' insiders and external shareholders (Amihud and Mendelson 2012). In theory, dividend policy influences stock liquidity because dividend payments signal inside information about the firm's future prospectus, thereby decreasing the level of information asymmetry between insiders and outsiders. Further, dividend policy influences stock liquidity because dividend payment imposes monitoring on managers, thereby preventing inefficient or opportunistic managers from concealing information. Paying dividends may also help firms to attract institutional investors (Allen et al. 2000; Grinstein and Michaely 2005) who have better-quality information (Amihud and Li 2006; Puckett and Yan 2011). Dennis and Weston (2002), Fehle (2004), and Jiang et al. (2011) find that firms with higher institutional ownership have greater stock liquidity as proxied by narrower spreads, higher market quality index, and smaller price impact of trades. Additionally, the high percentage of institutional ownership in dividend-paying firms should increase the trading volume of their stocks, since institutional investors tend to trade more frequently and in larger quantities (Gompers and Metrick 1998; Agarwal 2007; Rubin 2007; Brockman et al. 2009). Thus, dividend payment is expected to enhance the information environment and hence reduce information asymmetry. When information asymmetry is less severe, liquidity providers face less adverse selection problems (Glosten and Milgrom 1985). As a result, firms with dividend payments are expected to exhibit greater stock liquidity.[14]

[14] It is well recognized that better information quality and lower information asymmetry are highly correlated with improving the liquidity of a firm's shares (Bardos 2011). Liquidity is

Existing empirical evidence on the impact of dividend policy on stock liquidity is mixed. For example, Howe and Lin (1992) show that dividend policy has a negative effect on bid–ask spread. They attribute their results to information asymmetry theory, and argue that dividends reduce the level of information asymmetry and the hence bid–ask spread. However, Brooks (1994) and Barclay and Smith (1988) show that the relationship between dividend policy and bid–ask spread is at best weak. With regard to the trading activity aspect of stock liquidity, several studies, including those by Richardson et al. (1986), Gurgul et al. (2003), and Dasilas and Leventis (2011), find that trading volume increases with dividend increase and declines with dividend reduction. In general, existing empirical evidence on the consequences of dividend policy decisions in terms of stock liquidity is inconclusive and in some cases outdated; hence, further analysis is required.

Our sample includes all firms, including dead ones, listed as part of the FTSE ALL share index over the period 1996–2013. The final sample includes 1,041 firms after deleting missing observations. We use three liquidity measures reflecting three different dimensions of stock liquidity. These measures are: the proportional quoted bid–ask spread, which is a proxy for the trading cost; the turnover rate, which is a proxy for the trading activity; and the Amihud (2002) illiquidity ratio, which reflects the price impact.[15]

Our empirical analysis is stratified into two main stages. The first stage involves a univariate analysis in which the liquidity characteristics of stocks of dividend payers are compared against that of non-dividend payers, and the stock liquidity of high-dividend payers is compared to that of low-dividend payers. The univariate results suggest that stocks of dividend-paying firms are significantly more liquid that those of non-paying firms. Similarly, stocks of high-dividend-paying firms are significantly more liquid than those of low-dividend-paying firms.

negatively related to the level of information asymmetry that results from some traders having informational advantage over others (Glosten and Milgrom 1985; Kyle 1985).

[15] Studies that use similar proxies to measure stock liquidity include those by Brockman et al. (2008) in the context of share repurchases, and Mazouz et al. (2010) in the context of asset pricing.

The second stage involves the use of pooled Ordinary Least Square (OLS) regressions with year and industry dummies to control for endogeneity concerns and the effects of other variables on this relationship. We find that stocks of dividend payers exhibit significantly lower bid–ask spread and illiquidity ratio than their non-dividend-paying counterparts. Similarly, stocks of firms that pay high amounts of dividends have lower bid–ask spread and a lower illiquidity ratio compared to those that pay low amounts of dividends. These findings are consistent with the predictions of Bhattacharya's (1979) model, which suggests that dividends signal information to the market and hence decrease the level of information asymmetry, leading to higher stock liquidity. Moreover, these findings are in line with the model posited by Easterbrook (1984), which suggests that dividend-paying firms are more likely to visit the capital market, leading to higher levels of monitoring and hence more information being released to the market. However, the stock turnover ratio is found to be affected negatively by whether the firm pays dividends. This negative relationship may be due to the fact that stocks that pay dividends tend to be purchased and retained by investors, and thus fewer transactions occur (Hotchkiss and Lawrence 2007; IOSCO Emerging Markets Committee 2007).

We subject our results to a number of robustness tests and model specifications. First, analysing the impact of dividend policy on stock liquidity can be challenging due to the fact that dividend decisions are not randomly determined (Li and Prabhala 2005) and may be affected by unobserved factors that are also related to stock liquidity (Banerjee et al. 2007). Therefore, there is a potential endogeneity problem in estimating the relationship between dividend policy and stock liquidity. In other words, higher liquidity associated with dividend policy is potentially not an outcome of dividend policy as such, but rather an indication that stock liquidity itself may impact the decision to pay dividends. To control for possible endogeneity, we use a two-stage regression approach and fixed-effects model. Our main results are robust to these model specifications as we document that stock liquidity of dividend payers and payers of high amounts of dividends is higher than those of their non- or low-paying counterparts.

Second, we address the possibility that the relationship between dividend policy and stock liquidity is affected by the size of the firm. We find that compared to firms with no (low) dividends, firms that pay dividends (high dividends) have a significantly higher level of stock liquidity, especially when the firms themselves are larger. Large firms often face lower degrees of asymmetric information, which may explain their greater level of stock liquidity.

This chapter makes several contributions to the literature. First, we link stock liquidity to corporate finance. For example, many studies show that stock liquidity is influenced by stock repurchases (Brockman and Chung 2001; Ginglinger and Hamon 2007; Hillert et al. 2016), asset liquidity (Gopalan et al. 2012; Charoenwong et al. 2014), stock split (Goyenko et al. 2006; Huang et al. 2015), and corporate governance (Rubin 2007; Poon et al. 2013; Prommin et al. 2014). We contribute to this by identifying dividend policy as another influential determinant of liquidity. Given the few prior studies that examine the liquidity impact of dividend policy and their conflicting results, more empirical studies are warranted. Unlike previous studies that mostly investigate the relationship between dividend policy and stock liquidity by examining the changes in a certain measure of stock liquidity following dividend announcements (Richardson et al. 1986; Mitra and Rashid 1997; Bozos et al. 2011; Dasilas and Leventis 2011), we adopt a regression approach that enables us to test how a firm's dividend policy decisions determine its stock liquidity after controlling for other variables that are known to affect stock liquidity.

Previous studies typically focus on the impact of dividend policy on a single dimension of stock liquidity, such as the trading costs aspect, which is measured by bid–ask spread (Howe and Lin 1992; Mitra and Rashid 1997), or trading activity, measured by trading volume (Richardson et al. 1986; Bozos et al. 2011; Dasilas and Leventis 2011). However, stock liquidity reflects several aspects. Kyle (1985) and Lesmond (2005) argue that since liquidity is very difficult to define and even more difficult to estimate, a list of measures is required to capture its different aspects. Given the uncertainties surrounding liquidity estimation, we use proportional bid–ask spread, turnover ratio, and Amihud's (2002) illiquidity ratio to capture the impact of dividend policy on the trading costs, trading quantity, and price impact dimensions of liquidity, respectively. Further, our study complements earlier studies on the impact of dividend policy on firm value by introducing stock liquidity as a channel through which dividends affect firm value. Higher stock liquidity associated with dividend payments can result in a lower rate of return and higher firm valuation.[16] Finally, to best of our knowledge, this study is the first to examine the role of dividend policy decisions in determining stock liquidity in the UK. It is vital to research this area, given that the LSE is the second most active equity market, after the NYSE in the US.

The remainder of this chapter is organized as follows. Section 3.2 presents a brief review of the literature on the relationship between dividend and stock market liquidity. Section 3.3 states the hypotheses to be tested. Section 3.4 presents our sample and dataset. Section 3.5 describes our research methodology. Section 3.6 presents and discusses the empirical results. Section 3.7 concludes the chapter.

3.2. Literature review

The existing literature suggests that dividend policy can have a positive impact on stock liquidity. This positive relationship can be based on two propositions. The first proposition arises from the widely accepted notion that stock liquidity is negatively related to the level of asymmetric information. A large body of literature suggests that better information quality and lower information asymmetry are highly correlated with improving the liquidity of a firm's shares (Bardos 2011). Liquidity is negatively related to the level of information asymmetry that results from some traders having informational advantage over others (Glosten and Milgrom 1985; Kyle 1985). Glosten and Milgrom (1985) argue that the information revelation increases with trading activity, as informed traders trade aggressively on their information advantage for stocks with a high trading activity. As such, firms with liquid

[16] The impact of liquidity on rate of return has been widely documented (see, e.g., Amihud and Mendelson 1986; Brennan et al. 1998; Amihud 2002).

stocks are expected to be associated with low information asymmetry (Welker 1995; Richardson 2000). Some studies predict the bid-ask spread as an increasing function of the level of information asymmetry (Copeland and Galai 1983; Glosten and Milgrom 1985; Glosten and Harris 1988). Diamond (1985) shows that increased information disclosures decrease information asymmetry between managers and traders and diminishes traders' motivation to acquire private information, resulting in less heterogeneity among trader beliefs and smaller speculative positions among informed traders. Bhattacharya et al. (2013) provide empirical evidence that poor earnings quality results in higher information asymmetry, leading to higher trading costs and ultimately higher cost of capital.

The second proposition is related to different explanations about the role of dividend policy in financial markets. The first explanation pertains to the information signalling model, which suggests that dividends reduce asymmetric information by acting as a signalling mechanism (Bhattacharya 1979; John and Williams 1985; Miller and Rock 1985). Given that dividend payments are often thought to reflect higher future cash flows and better firm’s future prospects (Bhattacharya 1979; Miller and Rock 1985), this could decrease the asymmetric information level in the market and hence reduce the bid–ask spread, leading to higher stock liquidity.

The role of dividends in reducing agency costs (primarily monitoring costs) strengthens this conclusion and provides further explanation for the liquidity effect of dividends. This explanation is based on the separation of interests between managers and shareholders, as well as on the role of dividends as a disciplinary tool that reduces the agency costs associated with such a separation (see, e.g., Easterbrook 1984; Jensen 1986). The payment of dividends decreases free cash flow, pushing firms to visit the capital markets more frequently and reveal information while they attempt to obtain financing for their operations and investments. This leads them to be subject to the inspection of investment bankers, analysts, and potential new investors more often, leading to a reduction in agency costs as well as in the level of information asymmetry between managers and investors. Consequently, the payment of dividends should be associated with reduced information asymmetry and, hence, increased stock liquidity.

The clientele theory proposed by Allen et al. (2000) can also provide some explanation for the liquidity–dividend relationship. This theory rests on two assumptions. The first is that, due to tax effects, institutional investors prefer higher dividends relative to individual investors. Specifically, corporations and financial institutions are afforded lower marginal tax rates of dividends over capital gains. The second assumption is that because of their investment size and the amount of resources available to them, institutional investors have greater incentive and ability to collect and analyze information concerning their investments, as well as a greater ability to discipline managers and push for changes if management performs poorly. Based on these two assumptions, Allen et al. (2000) show that payment of dividends attracts institutional investors, and hence both agency costs and level of information asymmetry are reduced. Grinstein and Michaely (2005) find that there is significant evidence that institutions prefer dividend-paying firms compared to non-dividend-paying firms, even after holding constant size, risk, market-to-book ratio, and a host of other variables. Institutions are able to generate more information about a dividend-paying firm, thereby improving the quantity and quality of public information (Amihud and Li 2006; Puckett and Yan 2011). Given that institutional investors are more effective in gathering and analysing information about the firms in which they invest, the level of information asymmetry between firm insiders and outsiders is lower for firms that pay dividends (Allen et al. 2000; Leary and Michaely 2011). Consequently, increasing the information environment of dividend-paying stocks should lead to higher stock liquidity. Dennis and Weston (2002), Fehle (2004), and Jiang et al. (2011) find that firms with higher institutional ownership have greater stock liquidity, as proxied by narrower spreads, higher market quality index, and smaller price impact of trades.

Additionally, the high percentage of institutional ownership in dividend-paying firms should, all else being equal, increase the trading volume of their stocks. Gompers and Metrick (1998) examine the trading patterns of large institutional investors and find that they trade more frequently, and in larger quantities, than small investors do. Several studies show that institutional holdings are positively correlated with liquidity due to higher trading activity, which suggests that trades made by institutional investors are more frequent and larger in quantity compared to those of other investors (Bennett et al. 2003; Agarwal 2007; Rubin 2007; Brockman et al. 2009). Therefore, higher institutional ownership in dividend-paying firms should increase trading volume and decrease bid–ask spreads of their stock, leading to higher stock liquidity.[17]

Many empirical studies test the impact of dividend policy on a number of liquidity proxies. One strand of research examines the effect of dividend policy on the bid–ask spread, a measure of the trading costs aspect of liquidity. Howe and Lin (1992) examine the bid–ask spreads of the stocks of two groups of US firms: non-paying firms in a given year and firms that pay only cash dividends. They find that non-dividend stocks have an average bid–ask spread of 8.3%, while dividend-paying stocks have an average spread of 4.36%. Similarly, Mitra and Rashid (1997) examine the bid–ask spread before and after dividend initiations for a sample of US firms during the period January 1976 to December 1987. They find that the mean percentage and dollar bid–ask spreads increase significantly on the day preceding the announcement date. Nevertheless, on the announcement day, the mean percentage and the dollar bid–ask spread decline significantly and continue to remain low, on average, over year following the announcement date. Moreover, the results show that the magnitude of the decline in the post-event period percentage spread has a significant positive association with the magnitude of the dividend yield. The authors conclude that dividend events provide useful information to the market, and hence reduce informational asymmetry. Consequently, bid–ask spread decreases and stock liquidity improves. However, using a sample of 90 NYSE firms, Brooks (1994) finds that total spreads do not significantly change around the dividend announcement period, suggesting that dividend announcement is not informative.

[17] This might suggest that institutional ownership may interact with dividend policy and hence institutional ownership in non-dividend paying firms could increase stock liquidity. However, the lack of access to data on ownership structure prevents us from testing for this.

Another area of research examines the price reaction and the trading volume reaction to dividend change. Richardson et al. (1986) argue that the study of trading volume reactions is helpful in analysing the information content of dividends, as well as the existence of clientele effects. They argue that one implication of dividend clientele theory is that trading should increase after a dividend change as the firm's shareholder clientele adjusts. They test the abnormal trading volume, as well as abnormal returns around dividend changes, using a sample of 192 US firms that announced a cash dividend for the first time during the period 1969 to 1982. They investigate the weekly gross trading volume between initial dividend announcements and ex-dividend dates, and find that the trading volume during the dividend announcement week is 35% greater than that observed during a non-announcement week. In the period from the dividend announcement week to the ex-dividend date, trading volume is 54% greater than would occur normally over a similar interval.

Richardson et al. (1986) also examine whether trading volume response is related to good news about the firm's future or clientele adjustments. They argue that the abnormal trading volume is associated with two components: the information content of dividends, which is measured by abnormal returns, and clientele adjustments, which are measured by the magnitude of dividend yield. They state that "…tax clientele trading should be positively related to dividend magnitude, with less clientele trading for dividends of a trivial magnitude" (p. 326). When the only independent variable in their regression model is a measure of abnormal returns, a significant and positive intercept is interpreted as evidence of clientele trading. When variables representing dividend yield and prior price appreciation are added to the model, a positive (negative) and significant coefficient on the dividend yield (prior price appreciation) variable is interpreted as further evidence in support of clientele trading. Richardson et al. (1986) show that volume increases are primarily a response to the signal about future earnings, while the clientele adjustments are rather small.

Gurgul et al. (2003) examine abnormal trading volume reactions to dividend changes using 22 companies listed on the Austrian stock market between

January 1992 and April 2002. They perform their analysis using three groups of events: dividend increases, dividend decreases, and constant dividends. They report a positive abnormal trading volume on the day of announcements in all three groups, and interpret these results as evidence that any information on upcoming dividends is valuable for investors, resulting in intensified trading. Similarly, Bozos et al. (2011) analyze the trading volume around dividend announcements for a sample of 991 final dividend announcements of UK companies listed on the LSE over the period January 2006 to June 2010. The authors also divide the announcements into three groups: dividend increases, dividend decreases, and non-change dividends. They find that the two-day cumulative abnormal volumes are 0.729% and 0.707% for dividend increase and decrease events, respectively, and report an excess volume reaction for the unchanged dividend group of 0.773%. They interpret this finding as evidence that investors adjust their expectations for neutral dividend announcements.

Dasilas and Leventis (2011) also examine the trading volume around dividend changes for a sample of firms listed on the Athens Stock Exchange. Consistent with the signalling hypothesis, they find that dividend-increasing firms generate a positive abnormal trading volume of 19.02% and 6.78% on days 0 and +1, respectively. However, they show that dividend reductions result in significantly negative trading volume reaction. They argue that the negative trading volume reaction implies that investors tend to trade less than usual because dividend reductions are considered by the market as an indication of deterioration in the firm’s future performance, which discourages investors from buying shares. Dasilas and Leventis (2011) also find that the trading volume reaction to no-dividend change events is negative, although the volume reaction is not statistically significant during the whole estimation period.

From the above discussion, we note mixed results in the relationship between dividend policy and stock liquidity. Therefore, further analysis is warranted.

3.3. Hypothesis development

The effect of dividend policy on stock liquidity can be attributed to several explanations. The information signalling theory of dividends suggests that dividends convey information about the firm's future prospects (Bhattacharya 1979; John and Williams 1985; Miller and Rock 1985). If managers are expected to be better informed than investors about the future prospects of the firm, payment of dividends reduces information asymmetry. Therefore, the information content of dividend policy results in a lower level of information asymmetry, and hence a decrease in trading costs and increase in trading activity – i.e., improve stock liquidity. In addition, dividends play a role in monitoring managers, as dividend payments require the firm to visit the capital market more frequently, resulting in increased monitoring by providers of capital (Easterbrook 1984). Rozeff (1982) also contends that new-capital suppliers will provide funds only when they receive information about the potential use of those funds. Therefore, shareholders may also obtain new information and therefore the level of information asymmetry will be reduced, leading to lower trading costs and higher trading activity. Thus, improved monitoring through capital market disclosures also establishes a link between dividend policy and stock liquidity. The extant literature on market microstructure suggests a positive relationship between the level of information asymmetry and the magnitude of trading costs (Howe and Lin, 1992). Some studies predict the bid-ask spread as an increasing function of the level of information asymmetry (Copeland and Galai 1983; Glosten and Milgrom 1985; Glosten and Harris 1988). Glosten and Milgrom (1985) argue that the information revelation increases with trading activity and hence firms with liquid stocks are expected to be associated with low information asymmetry (Welker 1995; Richardson 2000).

Therefore, as dividend policy is associated with higher levels of information, information asymmetry should decrease. Consequently, trading costs should narrow and stock liquidity should improve.

The above arguments also imply that dividend policy can impact other dimensions of liquidity, such as price. The price impact on liquidity reflects the premium that a buyer or seller needs to make in order to effect a trade (Amihud and Mendelson 2012). For instance, when an investor receives new information that would result in an increase in the price of a stock, they will want to buy a large quantity of that stock at the current price. On the other hand, the seller of the stock would be better off holding that stock. Accordingly, once market makers (traders) notice any buying pressure, they are more likely to sell the stock to the buyer, but only at a higher price. Alternatively, if the market receives information that leads to a decrease in a stock's price, sellers will want to sell a large amount of that stock at the current price; hence, traders will interpret such selling pressure as a signal of negative information about the stock and tend to buy only at a lower price. Therefore, traders will protect themselves by demanding price premiums/discounts that increase with the quantity bought/sold. In both cases, the magnitude of the price impact increases with the level of asymmetric information between the trading parties. The higher the level of asymmetric information between the trading parties, the larger the risk that the party who starts the trade will try to profit from the situation, and the greater the compensation required by the counterparty for doing the trade. Consequently, a greater level of asymmetric information will result in a larger price impact (Amihud and Mendelson 2012).

Improvement in the trading environment, and hence stock liquidity, could also be driven by the number of market participants and transactions. Payment of dividends has been documented to attract institutional investors (Allen et al. 2000; Grinstein and Michaely 2005). Moreover, Short et al. (2002) show a significant positive relationship between dividend policy and institutional ownership. Hotchkiss and Lawrence (2007) find that the percentage of shares owned by institutional investors increases as dividends increase. Similarly, Crane et al. (2016) suggest that higher overall institutional ownership causes firms to pay more dividends. Given that institutional investors are highly effective in gathering and analysing information about the firms in which they invest, the level of information asymmetry between firm insiders and outsiders is lower for firms that pay dividends (Amihud and Li 2006; Puckett and Yan 2011). Consequently, increasing the information environment of dividend-paying stocks due to the existence of institutional investors should lead to higher stock liquidity. Additionally, many studies find that institutional investors trade more frequently, and in larger quantities, than other investors (Agarwal 2007; Rubin 2007; Brockman et al. 2009). Hence, the high percentage of institutional ownership in dividend-paying firms should also increase the trading volume of their stocks. Therefore, since dividends are associated with a high percentage of institutional investors that have more ability to generate information and trade in large quantity, dividend-paying firms are expected to have lower trading costs, higher trading activity and, accordingly, higher stock liquidity. Thus:

H1: Dividend-paying stocks are more liquid than non-dividend-paying stocks.

The above arguments further indicate that stock liquidity may also depend on the amount of dividend payment. A higher dividend reflects information on higher or more stable future cash flows (Bhattacharya 1979; Miller and Rock 1985). Furthermore, a higher amount of dividend payments indicates better future prospects; hence, the demand for, and the trading of, high-dividend-paying stocks will increase, resulting in improved stock liquidity. Additionally, a higher dividend indicates that the firm will visit the capital market more frequently, meaning that additional information will be available to market participants (Easterbrook 1984). The higher level of information associated with the higher dividend payment results in higher stock liquidity. This leads to the following hypothesis:

H2: Stocks that pay a higher amount of dividends are more liquid than stocks that pay a lower amount of dividends.

3.4. Data and sample

The study covers firms listed on the FTSE ALL share index, which represents an aggregate of the FTSE 100, FTSE 250, and FTSE SmallCap Indices. The FTSE All Share Index is a market-capitalization weighted index representing the performance of approximately 98% of capital value of all eligible companies listed on the LSE's main market that pass screening for size and liquidity. Using the current constituents of the FTSE ALL share index may result in a problem of survivorship bias in our sample. Survivorship bias is the tendency for unsuccessful firms to be dropped from performance studies because they no longer exist. This problem can yield an upward bias, as only firms that were successful enough to survive until the end of the study period are included. In order to overcome this problem, we include the dead firms that disappeared any time before the end of the sampling period. This yields an initial sample of 1,723 firms. Following criteria used in previous studies (e.g., Banerjee et al. 2007; Brockman et al. 2008), we exclude firms from the financial and utilities industries, and thus obtain a sample of 1,169 firms over a period from 1996 to 2013, as summarized in Panel A of Table 3.1.[18] Panel B of Table 3.1 shows the distribution of our sample firms across industries based on the Industry Classification Benchmark (ICB).[19] Over 28% of the sample is from the industrial sector, followed by 26.18% from consumer services and 13.34% from consumer goods. Firms in the telecommunications industries account for around 2% of the total. Panel C of Table 3.1 represents the yearly distributions of our sample firms. As illustrated above, the sample is not the same for every year because of frequent revisions to the constituents of the FTSE ALL index.

[18] We exclude financial and utilities firms because they have a different set of regulations and their financial ratios are not comparable with firms in other industries.

[19] The ICB is a definitive system categorizing over 70,000 companies and 75,000 securities worldwide, enabling the comparison of companies across four levels of classification and national boundaries. The ICB system is supported by the ICB Database, an unrivalled data source for global sector analysis, which is maintained by FTSE International Limited (see http://www.icbenchmark.com).

Table 3.1 Sample firms' distribution across year and industry

Panel A illustrates criteria for inclusion in the sample. Panel B shows the distribution of sample firms across industries based on the "Industry Classification Benchmark (ICB) Level 1" extracted from DataStream. Panel C shows the distribution of observations by year.

Panel A

Selection Criteria for the Sample

Criterion	# of Firms
All firms listed on the FTSE ALL Share during 1996–2013 (dead and alive)	1723
Financial firms	521
Utilities	33
Sample (excluding financials & utilities)	1169

Panel B

Distribution of the Sample across Industries

Industry	# of Firms	%
Basic materials	83	7.1
Consumer goods	156	13.34
Consumer services	306	26.18
Health care	75	6.42
Industrials	336	28.74
Oil & gas	52	4.45
Technology	135	11.55
Telecommunications	26	2.22
Total	1,169	100

Panel C

Distribution of the Sample across Time

Year	# of Firms
1996	647
1997	647
1998	586
1999	563
2000	532
2001	493
2002	474
2003	469
2004	470
2005	443
2006	428
2007	424
2008	401
2009	356
2010	360
2011	358
2012	355
2013	342
Total	1169

The primary dataset is taken from DataStream, which consists of both daily and annual data for all stocks (dead and live). The daily data includes closing price, ask price, bid price, quantity trading volume, and number of outstanding shares. Annual data consists of dividend per share, total assets, and earnings before interest and taxes. After deleting all the observations with missing values, we end up with 8,780 firm-year observations for 1,041 firms. All the variables are winsorized at the 1st and 99th percentiles to reduce the impact of outliers.

3.5. Methodology

3.5.1. Variable definitions

This section presents definitions of the dependent, independent, and control variables used in this chapter. The discussion focuses on stock liquidity variables, where the dependent variables include proportional bid–ask spread, turnover ratio, and Amihud's (2002) illiquidity ratio. In addition, it defines the dividend policy and control variables and provides information about the measurements of all variables used in this chapter. Table 3.2 summarizes the definitions of these variables.

3.5.1.1. Liquidity measures

The dependent variables reflect stock liquidity measures. There is no consensus in the literature on the definition and measurement of stock liquidity, though many have been suggested. Most of the literature examining liquidity focuses on its various dimensions (see, e.g., Kyle 1985 and Baker 1996 for further discussion). In general, it has been concluded that there "is no single unambiguous theoretically correct or universally accepted definition of liquidity" (Baker 1996: 1). Keeping all these points in mind, and due to the lack of a single good measure, this study applies the following widely accepted measures of stock liquidity to capture its different dimensions. More specifically, we investigate the link between dividend policy and different aspects of liquidity, including trading costs (i.e., bid–ask spread), trading activity (i.e., turnover ratio), and price impact (i.e., Amihud (2002) illiquidity ratio).[20] According to the market microstructure literature, decreased bid–ask spread, increased turnover ratio, and decreased illiquidity ratio have an incremental effect on stock liquidity. We construct these measures by calculating the average for a given firm in a given year.

Proportional bid–ask spread (Spread)

The bid–ask spread is the difference between the prices quoted for an immediate purchase (bid) and those for an immediate sale (ask). It is probably one of the most popular proxies for liquidity, and Amihud (2002) and Goyenko et al. (2009) argue that it is one of the best. The market microstructure literature finds that the bid–ask spread may reflect the following: (1) order processing cost, (2) inventory carrying cost, (3) asymmetric information cost, and (4) market structure cost (Huang and Stoll 1996). This captures most of the transaction cost. Many empirical works on the corporate finance–liquidity relationship adopt the bid–ask spread as a proxy of liquidity. For example, Rubin (2007) and Poon et al. (2013) rely on the bid–ask spread to examine the effects of ownership structure on stock liquidity. This measure is easy to calculate and can make the liquidity of different stocks comparable to each other. Moreover, it can be calculated even if no trade takes place (Brennan et al. 1998; Jones 2002).[21]

Turnover ratio (Turnover)

We use average daily turnover ratio to investigate the impact of dividend policy on the trading quantity dimension of liquidity. This ratio is used by Leuz and Verrecchia (2000) and Leuz (2003) as a measure for the level of information asymmetry, measured as the product of the number of shares traded and the stock price, to the stock's market capitalization. Trading activity measures are considered good proxies for stock liquidity because

[20] Studies that use similar proxies to measure stock liquidity include those by Brockman et al. (2008) in the context of share repurchases, and Mazouz et al. (2010) in the context of asset pricing.
[21] The liquidity costs contain some components that might be measured inaccurately. For example, the adverse selection component of the bid–ask spread needs "high-frequency data". However, due to the lack of disclosure about information with regard to this component, we measure the low-frequency measures of stock liquidity.

they are highly associated with the bid–ask spread and other measures of liquidity. Additionally, in equilibrium, liquidity is correlated with the trading frequency. Thus, if liquidity cannot be observed directly while the turnover ratio can, then the latter can be used as a proxy for liquidity. The turnover ratio has also been widely used as a proxy for liquidity (see, e.g., Brennan et al. 1998; Datar et al. 1998; Chordia et al. 2001b; Avramov et al. 2006; Prommin et al. 2014; Huamng et al. 2015, among others), perhaps because it can be easily calculated using readily available data (e.g., daily data).

Amihud's (2002) illiquidity ratio (Amihud)

Although the bid–ask spread closely approximates the cost of purchasing or selling a small number of shares, it ignores the potential price impact of trading many shares. In this study, we also consider the price impact measure proposed by Amihud (2002). In particular, Amihud (2002) develops a liquidity proxy that measures the daily price response associated with one dollar of trading volume. This proxy closely follows the intuitive definition of liquid markets as those that accommodate trading with the minimum impact on price. In other words, a stock would have a high level of liquidity if the stock's price moves little in response to a large trading volume. Many empirical studies employ Amihud's liquidity proxy to measure the impact of corporate decisions, such as share repurchases (Hillert et al. 2016) and stock split (Huang et al. 2015), on stock liquidity. Using data from the US stock markets, Goyenko et al. (2009) and Hasbrouck (2009) show that Amihud's illiquidity outperforms other measures in capturing the transaction costs.

3.5.1.2. Main explanatory variable

Our main explanatory variable represents the dividend policy. In this study, two main proxies are employed to reflect the firm's two dividend policy decisions: the decision to pay dividends and the amount of dividends to be paid. The first proxy will measure the firm's dividend payment decisions ($DIV_{i,t}$) and is a dummy variable having a value of 1 for dividend payers and 0 for non-dividend payers (see, e.g., Ferris et al. 2009; Kuo et al. 2013). The second proxy is the amount of dividend decision ($HighDPS_{i,t}$), and is a binary variable having a value of 1 for stocks with dividend per share ($DPS_{i,t}$) above the median, and 0 otherwise.[22] The continuous variable ($DPS_{i,t}$) is also used to measure the amount of dividend decision.

3.5.1.3. Control variables

We use several control variables identified in the literature as main determinants of stock liquidity. First, we control for the volatility of returns. High return volatility can be viewed as high firm risk and high inventory risk faced by market makers (Amihud and Mendelson 1980; Ho and Stoll 1983; O'Hara and Oldfield 1986; Poon et al. 2013). Moreover, it is associated with a high level of information asymmetry between firm insiders and outsiders, as well as between investors with different information sets (Poon et al. 2013). Thus, we expect to detect a negative relationship between return volatility and stock liquidity (Chung et al. 2010; Jacoby and Zheng 2010; Gopalan et al. 2012; Poon et al. 2013; Andres et al. 2014). Following Poon et al. (2013) and Prommin et al. (2014), we measure return volatility (*Volatility*) using the standard deviation of daily return over the year. Firm market performance – i.e., stock returns – can affect the firm's return volatility and hence stock liquidity (Hameed et al. 2010); therefore, it is important to control for this. Annual returns could reflect a firm's economic prosperity, as firms with positive future earnings may have positive returns (Andres et al. 2014). The higher the annual returns, the higher the stock liquidity of a firm. The

[22] These variables have been chosen to capture the fact that dividend policy involves two decisions: the probability to pay and the amount of dividend paid (e.g., Li and Lie, 2006; Kim and Jang, 2010; Alphonse and Tran, 2014).

firm’s daily returns are averaged over the year to get the annual return (*Return*) (Gopalan et al. 2012; Poon et al. 2013; Andres et al. 2014; Charoenwong et al. 2014; Hillert et al. 2016).

Besides these market-based control variables, which are commonly used in the literature, we control for the impact of several accounting-related firm characteristics. Banerjee et al. (2007) argue that both dividend policy and stock liquidity can be related to several common factors, including firm size, profitability, and growth opportunities. According to Banerjee et al. (2007), to examine the link between firm dividend policy and liquidity it is important to control for other variables that are most expected to affect the direction and strength of the relationship between stock liquidity and dividend policy. Existing studies have identified firm size, profitability, and growth opportunities as primary determinants of dividend policy (see, e.g., Fama and French 2001; Denis and Osobov 2008; Fatemi and Bildik 2012). Moreover, stock liquidity has been documented to be affected by these variables (see, e.g., Chordia et al. 2004; Chung et al. 2010; Ertimur 2004; Dass et al. 2011; Gopalan et al. 2012). From a theoretical perspective, there is a positive relationship between firm size and stock liquidity, in that as the firm’s size increases, the liquidity of its stock will increase. A large firm is more likely to be followed by analysts and attract investors than a small firm (Riahi et al. 2013). Moreover, a large firm is more able to disclose a lot of information, thus reducing the level of information asymmetry and improving stock liquidity (Loukil et al. 2010). Several studies show that small stocks are less liquid than large ones (Stoll and Whaley 1983; Stoll 2000; Chung et al. 2010; Gopalan et al. 2012). Following Kim and Jang (2010), Chung et al. (2010), Poon et al. (2013), and Hillert et al. (2016), the natural logarithm of the book value of total assets is used as a proxy for firm size (*Size*).

Stock liquidity also relates to the firm’s operating performance. The literature suggests that investors prefer to buy stocks of profitable firms. It is also suggested that financially healthy firms are easier to sell than those facing financial difficulties. In particular, a firm with strong earnings and profits should be subject to a smaller illiquidity discount than one with losses. For example, using bid–ask spreads as a proxy for the level of information asymmetry, Ertimur (2004) finds that loss-making firms indeed experience a higher bid–ask spread than profitable firms do. Gopalan et al. (2012) and Charoenwong et al. (2014) find that firms with low levels of profitability have less liquid stock. Thus, we expect that liquidity is positively related to the firm's profitability. We measure firm profitability (*Profitability*) as the ratio of earnings before interest and taxes to total assets (Banerjee et al. 2007).

Similarly, stock liquidity tends to be more valuable for firms with more growth opportunities. Therefore, it is expected that such firms may find ways to make their stock more liquid in order to reduce their cost of capital (Amihud and Mendelson 2012). Moreover, Dass et al. (2011) examine the stock liquidity of firms with high growth opportunities (firms with high levels of R&D), and find that the stocks of these firms are significantly more liquid than those of otherwise comparable firms. Consequently, the relationship between growth opportunities and stock liquidity is expected to be positive. Following Fama and French (2001), Fama and French (2002), Banerjee et al. (2007), and Hussainey et al. (2011), growth opportunities (*Growth*) is measured as the ratio of the percentage changes in total assets.

Table 3.2 Variables definitions and measurements

This table presents the definitions and measurements of our variables used in this study, and the expected signs of the explanatory variables.

Variable (Code)	Definition	Exp. Sign	Related Studies
Dependent Variables: Stock Liquidity (Liq)			
Proportional bid–ask spread (Spread)	$Spread_{i,t} = \frac{1}{N_t}\sum_{t=1}^{N_t}\left[\frac{2(p_i^A - p_i^B)}{p_i^A + p_i^B}\right]$		Howe and Lin (1992) Mitra and Rashid (1997) Brockman et al. (2008)
Turnover ratio (Turnover)	The ratio of stock trading volume ($VOLQ$) to the number of shares outstanding (NO) $Turnover_{i,t} = \frac{1}{N_t}\sum_{t=1}^{N_t}\left[\frac{VOLQ_i}{NO_i}\right]$		Banerjee et al. (2007) Brockman et al. (2008) Griffin (2010) Kuo et al. (2013)
Amihud's (2002) illiquidity ratio (Amihud)	Absolute (r) divided by the trading dollar volume $(VOLD)$ $Amihud_{i,t} = \frac{1}{N_t}\sum_{t=1}^{N_t}\left[\frac{\lvert r_i\rvert}{VOLD_i}\right]$		Banerjee et al. (2007) Brockman et al. (2008) Kuo et al. (2013)
Key Explanatory Variables: Dividend Policy			
Dividend payment decision (DIV)	Dummy variable equal to 1 if the stock is a dividend payer and 0 otherwise $DIV_{i,t} = \begin{cases}1, & DIVP_{i,t} > 0\\ 0, & DIVP_{i,t} = 0\end{cases}$	Positive (Turnover) Negative (Spread and Amihud)	Howe and Lin (1992) Mitra and Rashid (1997) Gurgul et al. (2003) Dasilas and Leventis (2010) Bozos et al. (2010)
Amount of dividend decision (HighDPS)	Dummy variable equal to 1 if the stock pays a dividend higher than the median of dividend per share and 0 otherwise $HighDPS_{i,t} = \begin{cases}1, & DPS_{i,t} > Median(DPS_{i,t})\\ 0, & DPS_{i,t} < Median(DPS_{i,t})\end{cases}$	Positive (with Turnover) Negative (with Spread and Amihud)	
Control Variables			
Firm size (Size)	Natural logarithm of book value of total assets: $Size_{i,t} = LN(assets_{i,t})$	Positive (with Turnover) Negative (with Spread and Amihud)	Stoll (2000) Chung et al. (2010) Gopalan et al. (2012) Poon et al. (2013) Hillert et al. (2016)
Return volatility (Volatility)	Standard deviation of daily returns over a year	Negative (with Turnover) Positive (with Spread and Amihud)	Chung et al. (2010) Jacoby and Zheng (2010) Gopalan et al. (2012) Poon et al. (2013) Andres et al. (2014)
Stock return (Return)	Daily return is averaged over the year	Negative (with Turnover) Positive (with Spread and Amihud)	Poon et al. (2013) Andres et al. (2014) Hillert et al. (2016)
Firm profitability (Profitability)	Earnings before interest and taxes $(EBIT)$ divided by book value of total assets: $Profitability_{i,t} = \frac{(EBIT)_{i,t}}{assets_{i,t}}$	Positive (with Turnover) Negative (with Spread and Amihud)	Ertimur (2004) Dass et al. (2011) Gopalan et al. (2012)
Growth opportunities (Growth)	Percentage changes in book value of total assets $GROWTH_{\boldsymbol{i,t}} = \frac{assets_{i,t} - assets_{i,t-1}}{assets_{i,t}}$	Positive (with Turnover) Negative (with Spread and Amihud)	Dass et al. (2011) Amihud and Mendelson (2012) Gopalan et al. (2012) Hillert et al. (2016)

3.5.2. Empirical models

To examine the impact of dividend policy decisions on stock liquidity, we estimate the following model:[23]

$$LIQ_{i,t} = \beta_0 + \beta_1 Dividend\ policy_{i,t} + \gamma Controls_{i,t} + (YearDummies) + IndustryDummies + \varepsilon i,t \qquad (3.1)$$

where $LIQ_{i,t}$ is the stock liquidity variable measured by three different proxies, namely bid–ask spread, turnover ratio, and illiquidity ratio. Our choice of liquidity measures is driven by our desire to cover different aspects of liquidity. Therefore, we employ bid–ask spread ($Spread_{i,t}$) to reflect trading costs aspect, turnover ratio ($Turnover_{i,t}$) to reflect trading activity aspect, and illiquidity ratio ($Amihud_{i,t}$) to reflect price impact aspect. $Dividend\ policy_{i,t}$ is a dummy variable that reflects dividend policy decisions. It is measured by $DIV_{i,t}$ to reflect the dividend payment decision and $HighDPS_{i,t}$ to reflect the amount of dividend paid. $Controls_{i,t}$ are control variables. All variables are standardized to have a zero mean and unit variance in each year.

To control for simultaneity, this study follows the common practice of using lagged values of the independent variables (Reed 2013; Bellemare et al. 2015).[24] We also follow previous finance studies and include year and industry fixed effects to control for the effect of time and industry unobserved heterogeneity (see, e.g., Gopalan et al. 2012; Poon et al. 2013; Prommin et al. 2014; Hillert et al. 2016).[25] Dummy variables are those that undertake the value 0 or 1 to reflect the absence or presence of a categorical effect that may be expected to change the outcome. Given the possibility that the

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[23] A similar approach is used by previous studies that relate corporate finance to stock liquidity (e.g., Hillert et al. 2016; Prommin et al. 2014; Poon et al. 2013; Rubin 2007). See Appendix A for an explanation of using pooled regressions with year- and industry fixed-effects models.

[24] For example, Reed (2013) states that replacing a suspected endogenous variable with its lagged values is the common practice in applied econometrics. Bellemare et al. (2015: 5) state that "Frequently, applied researchers propose to use a lagged value of an explanatory variable X in order to 'exogenize' it when estimating the causal effect of X on Y. Since Yt cannot possibly cause Xt−1, the argument goes, replacing Xt with Xt−1 obviates concerns that X is endogenous to Y."

[25] Unobservable heterogeneity refers to the variables that are not in a model or an analysis but could have influence on both the cause and effect and so may cause bias (Shadish et al. 2002).

variables of this study may change over the study period, including year dummies will control for the trends of dividend policy. To capture this effect, we include a dummy variable for each year in the period of the study. In addition, we include industry dummies to reflect industry-specific factors that affect the determinants of stock liquidity (e.g., Poon et al. 2013). The dividend policy may differ across industries (Dhanani 2005; Kang 2006; Mahdzan et al. 2016). For instance, Dhanani (2005) and Kang (2006) state that firms in different industries follow different dividend policies because each industry has different characteristics, such as investment opportunities, regulations, and financial structure. Mahdzan et al. (2016) argue that different industries have distinct business natures and operate differently. Hence, corporate dividend patterns and dividend payout policies may vary across industries.

3.6. Empirical results

3.6.1. Descriptive statistics

Panel A of Table 3.3 reports the descriptive statistics of the main variables used in this study.[26] The average dividend per share (DPS) is 0.091, implying that, on average, UK firms paid £0.091 DPS during the study period. 75% of UK firms paid dividends during the study period. The yearly mean proportional bid–ask spread is 2.9%, which is comparable to the spread of 2.1% reported in the US over the period 1947–2008 (Næs et al. 2011). The average of the Amihud (2002) illiquidity ratio is 0.002, suggesting that, on average, stock price moves by 0.2% for each one dollar of trading volume. The yearly average of the stock turnover ratio is 0.4%. All these averages exceed the median values, indicating the presence of skewness in the distributions of our variables. Furthermore, on average, each of the FTSE ALL index shares grows by 5% over the entire study period and has an average size in logs of total assets of 12.6. The average profitability ratio is 5% indicating that earnings before interest and taxes represent 5% of total assets. The return volatility has an average of 2.1%. Similar volatility figures

[26] In Appendix B, we report the descriptive statistics of the sample of dividend-paying firms only.

are reported by Chung et al. (2010) (2.39%) and Rubin (2007) (2.92%) in the case of the US.

Panel B of Table 3.3 reports the correlation matrix of the variables used in this study. With regards to the alternative liquidity measures, all correlations have the right sign. Bid–ask spread and illiquidity ratio are positively correlated and both are negatively correlated with turnover ratio.[27] All correlations of liquidity measures with respect to *DPS* appear to have the right sign. With the exception of its negative correlation with turnover ratio, the correlation between the dividend payment decision (*DIV*) variable and other liquidity measures are of the expected sign. As for the control variables, we report several significant correlations which are consistent with prior stock liquidity literature. The turnover ratio is positively correlated with the firm size, while the bid–ask spread and the illiquidity ratio are negatively correlated with firm size. These correlations are consistent with the view that large firms tend to have more liquid stock (e.g., Chordia et al. 2004; Chung et al. 2010 ; Loukil et al. 2010). Bid–ask spread and illiquidity ratio are negatively related to stock returns (Gopalan et al. 2012) but positively related to return volatility (Gopalan et al. 2012; Poon et al. 2013). However, an unexpected negative correlation exists between the turnover ratio and both profitability and growth opportunities. These results contradict the predictions that profitable and growing firms have more stock liquidity (Dass et al. 2011; Amihud and Mendelson 2012). However, all these correlation results should be viewed with caution as they do not control for several factors that influence liquidity.

[27] These correlation patterns are consistent with the findings of previous studies (see, e.g., Rubin 2007).

Table 3.3 Descriptive statistics and correlation matrix of variables

Panel A reports descriptive statistics of yearly observations of the main variables of the study. Panel B reports the correlation coefficients among the dependent and independent variables. The sample consists of 8,780 firm-year observations over the period from 1996 to 2013. Spread denotes the proportional quoted bid–ask spread, Turnover is the turnover rate, Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. Size is the firm size. Growth is the growth opportunities. Profitability is the firm profitability. Return is the average of daily returns over a year. Volatility is the standard deviation of daily returns over a year. DPS is the dividend per share. DIV is a dummy variable which equals 1 for dividend payers and zero otherwise. See Table 3.1 for variables measurement. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

Panel A: Descriptive Statistics

	DPS	DIV	Turnover	Spread	Amihud	Size	Growth	Profitability	Return	Volatility
Observations	8780	8780	8780	8780	8780	8780	8780	8780	8780	8780
Mean	0.0907	0.7513	0.0035	0.0288	0.0018	12.5533	0.0496	0.0497	-0.0001	0.0207
Median	0.0460	1.0000	0.0027	0.0197	0.0001	12.3502	0.0489	0.0788	0.0000	0.0187
SD	0.1458	0.4323	0.0030	0.0314	0.0057	1.8127	0.2727	0.1798	0.0020	0.0180
Min	0.0000	0.0000	0.0002	0.0006	0.0000	8.6149	-1.1676	-0.9234	-0.0083	0.0000
Max	0.9410	1.0000	0.0169	0.1702	0.0415	17.4918	0.8016	0.3866	0.0055	0.0948

Panel B: Correlation Matrix

	DPS	DIV	Turnover	Spread	Amihud	Size	Growth	Profitability	Return	Volatility
DPS	1									
DIV	0.3581***	1								
Turnover	0.0627***	-0.0388***	1							
Spread	-0.2908***	-0.4031***	-0.2468***	1						
Amihud	-0.1567***	-0.2803***	-0.1776***	0.5938***	1					
Size	0.4202***	0.3357***	0.3035***	-0.6149***	-0.3067***	1				
Growth	0.0488***	0.1465***	-0.0403***	-0.2268***	-0.2028***	0.0861***	1			
Profitability	0.2329***	0.4815***	-0.0550***	-0.3990***	-0.2466***	0.2568***	0.4260***	1		
Return	0.0198*	0.0473***	-0.0056	-0.0872***	-0.0852***	0.0474***	0.0589***	0.0856***	1	
Volatility	-0.0748***	-0.1580***	0.0413***	0.1544***	0.1185***	-0.1028***	-0.0171	-0.1154***	-0.3080***	1

DPS has a positive correlation with firm profitability, indicating that as firm profitability increases, dividends also increase, thus firms with high profitability are more able to use internal sources of funds to pay dividends (Fama and French 2001; Denis and Osobov 2008). However, *DPS* is positively correlated with growth opportunities, which is inconsistent with the view that firms with high-growth opportunities tend to pay lower dividends (see, e.g., Fama and French 2001; DeAngelo et al. 2006). However, Aivazian et al. (2003) find similar results in the context of developing countries. Furthermore, firm size is positively related to *DPS*, suggesting that large firms are more likely to pay dividends (Al-Malkawi 2007; Kim and Jang 2010). Similar results are reported for *DIV* dummy variables, which indicates that large, profitable high-growth firms are more likely to pay dividends.

There does not appear to be high correlation between any two of the explanatory variables. The correlation coefficients are generally low (<0.5), implying an absence of multicollinearity among the explanatory variables. As a further check for multicollinearity, we use the Variance Inflation Factor (VIF):

$$VIF = 1/(1 - R^2)$$

where R^2 is the coefficient determination of a certain explanatory variable's regression on all other explanatory variables. The explanatory variable is considered to be collinear with other explanatory variables if the VIF coefficient of the variable is more than five (Berenson et al. 2009). However, if the VIF coefficient for any explanatory variable is equal to one, then that variable is independent of other variables, i.e., collinearity does not have any significant effect on the relationship between the explanatory variable and the dependent variable. We perform a collinearity test between the explanatory variables (dividend policy variables, firm size, growth opportunities, profitability, returns and volatility) to test the presence of collinearity between the explanatory variables with a significant effect on the relationship between the explanatory variables and the dependent variable. The values of the VIF were calculated by performing Collinearity Diagnostics (see Table 3.4).

Table 3.4 Variance inflation factor (VIF)

This table presents the VIF between the explanatory variables. Size is the firm size. Growth is the growth opportunities. Profitability is the firm profitability. Return is the average of daily returns over a year. Volatility is the standard deviation of daily returns over a year. DPS is the dividend per share. DIV is a dummy variable which equals one for dividend payers and zero otherwise. See Table 3.1 for variables measurement.

Variable	VIF	Tolerance	R-Squared
DPS	1.3	0.7682	0.2318
DIV	1.48	0.6771	0.3229
Size	1.29	0.775	0.225
Growth	1.23	0.8113	0.1887
Profitability	1.59	0.6275	0.3725
Return	1.11	0.9004	0.0996
Volatility	1.13	0.8812	0.1188
Mean	1.31		

Table 3.5 Means of stock liquidity across industry sectors

This table presents the average of stock liquidity measures according to the industry classification over the sample period. For stock liquidity this study uses proportional bid–ask spread (Spread), turnover ratio (Turnover), and Amihud's illiquidity ratio (Amihud).

Industry	Turnover	Spread	Amihud
Basic Materials	0.0034	0.0255	0.0017
Consumer Goods	0.0030	0.0280	0.0017
Consumer Services	0.0039	0.0243	0.0016
Health Care	0.0032	0.0363	0.0023
Industrials	0.0031	0.0278	0.0017
Oil & Gas	0.0036	0.0282	0.0011
Technology	0.0042	0.0413	0.0027
Telecommunications	0.0047	0.0186	0.0004

Table 3.5 shows how stock liquidity varies across industries. Technology and health care companies have the highest proportional bid–ask spread (*Spread*), 4.13% and 3.63% respectively. In contrast, telecommunication companies have the lowest *Spread* with an average of 1.86%. Regarding the Amihud illiquidity ratio (*Amihud*), telecommunication companies have the lowest illiquidity ratio with an average of 0.04%. Nevertheless, health care and technology have the highest illiquidity ratios with an average of 0.23% and 0.27%, respectively. Regarding turnover ratio (*Turnover*), telecommunication firms have the highest turnover ratio average of 0.47%,

while consumer goods companies have the lowest average of 0.30%. We use industry dummies to control for the variations in liquidity across industries.

3.6.2. Univariate results

This section examines the effect of dividend policy on stock liquidity using univariate analysis. This analysis involves a comparison of the stock liquidity using three different measures for two sets of groups: dividend-paying stocks and non-dividend-paying stocks as well as high-dividend-paying stocks and low-dividend-paying stocks. Panel A of Table 3.6 contains descriptive data for dividend-paying stocks and non-dividend-paying stocks. The results show that the average (median) bid–ask spread and illiquidity ratio for dividend-paying stocks over the entire period are 2.2% (0.09%). These figures are lower than their counterparts of non-dividend-paying stocks which exhibit an average (median) bid–ask spread and illiquidity ratio of 5.08% (0.46%). The t-test and the Mann Whitney test indicate that dividend payers exhibit significantly lower bid–ask spread and illiquidity ratio than non-dividend payers. These results are consistent with our hypothesis (H1), which suggests that stocks of dividend-paying firms are significantly more liquid than those of non-dividend-paying firms. These results are consistent with Howe and Lin (1992) who find that, on average, dividend-paying stocks have a lower bid–ask spread than non-paying stocks. However, the turnover ratio of dividends paying stocks has an average (median) of 0.34% (0.26%), which is lower than non-dividend-paying stocks. This result contradicts our prediction of a positive association between dividend payment and trading activity, as dividend-paying firms are more favourable to large investors such as institutional investors (Allen et al. 2000; Grinstein and Michaely 2005). Institutional investors have the ability to trade more frequently and in large quantities and hence increase stock liquidity due to higher trading activity (Rubin 2007). However, this result may suggest that although financial institutions are more likely to buy dividend-paying stocks because of their preference for holding higher-yielding stocks, they tend to be more passive “buy and hold” investors (Hotchkiss and Lawrence 2007; IOSCO Emerging

Markets Committee 2007: 12), and hence their transactions occur less frequently.

Table 3.6 Univariate analysis

This table reports descriptive statistics of the yearly observations of the liquidity measures of dividend-paying stocks and non-dividend-paying stocks (Panel A) and high-dividend-paying stocks and low-dividend-paying stocks (Panel B). The t-tests and Mann Whitney tests are used to test the significance of the differences in the averages of the liquidity measures of the two sets of stocks. Spread denotes the proportional quoted bid–ask spread, Turnover is the turnover rate and Amihud is the Amihud (2002) illiquidity ratio. See Table 3.2 for variables measurement. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

Panel A: Dividend payers vs. non-dividend payers						
	Dividend-paying stocks		Non-dividend-paying stocks		Differences between dividend-paying and non-dividend-paying stocks	
	Mean	Median	Mean	Median	t-Stat	Mann Whitney
Spread	0.0216	0.0163	0.0508	0.0394	30.5994***	33.194***
Turnover	0.0034	0.0026	0.0037	0.0027	3.3470***	0.985
Amihud	0.0009	0.0001	0.0046	0.0005	17.6184***	27.660***
Panel B: High-dividend payers vs. low-dividend payers						
	High-dividend-paying stocks		Low-dividend-paying stocks		Differences between high-dividend payers’ and low-dividend payers’ stocks	
	Mean	Median	Mean	Median	t-Stat	Mann Whitney
Spread	0.0141	0.0092	0.0286	0.0236	29.967***	32.550***
Turnover	0.0038	0.0029	0.0031	0.0024	-10.129***	-9.917***
Amihud	0.0003	0.0000	0.0012	0.0002	18.372***	30.535***

Another univariate analysis is conducted to examine the effect of the amount of dividend on stock liquidity using two sets of stocks: high-dividend-paying (dividend per share>median) and low-dividend-paying (dividend per share<median) stocks. The results in Panel B of Table 3.6 show that high-dividend-paying stocks exhibit an average (a median) bid–ask spread and illiquidity ratio of 1.41% (0.92%) and 0.03% (0.00%), respectively. These figures are lower than that of low-dividend-paying stocks. Moreover, high-dividend payers have an average (a median) turnover ratio of 0.38% (0.29%), which is higher than that of low-dividend payers. The differences in the three liquidity measures of the two groups are significant, as confirmed by the t-test and the Mann Whitney. This provides evidence to support our

hypothesis (H2), which states that stocks of high-dividend payers are significantly more liquid than those of low-dividend payers.

Thus, preliminary results suggest a positive effect of dividend policy decisions on the stock liquidity. However, the differences in stock liquidity measures may be attributable to changes in other factors (firm size, growth opportunities, profitability, etc). Therefore, to examine the relationship between stock liquidity and dividend policy decisions while accounting for the possible explanatory power of these variables on stock liquidity, we move to the second stage of the analysis.

3.6.3. Multivariate results

3.6.3.1. The impact of decisions to pay dividends on stock liquidity

In this section, we examine the impact of dividend payment decisions on different aspects of stock liquidity while controlling for other factors that can affect this relationship. Table 3.7 presents the results of the pooled OLS regression analysis where dividend policy is measured by dividend payment decision dummy variable (*DIV*). The t-statistics shown in parentheses are based on robust standard errors adjusted for heteroscedasticity and firm clustering. The coefficient on the dividend payment dummy (*DIV*) is negatively and statistically associated with both bid–ask spread and illiquidity ratio. These findings strongly support our first hypothesis (H1). This result is consistent with Howe and Lin (1992), who find that dividend-paying stocks have on average a lower bid–ask spread than non-paying stocks. It is also consistent with the view that a greater level of asymmetric information will result in a larger price impact (Amihud and Mendelson 2012). Mitra and Rashid (1997) conclude that the dividend payment decisions provide useful information to the market and hence reduce informational asymmetry. Consequently, bid–ask spread and price impact decrease and stock liquidity improves. The economic significance of these results is also important. For instance, dividend payers have bid–ask spread that is 0.35 standard deviations lower than those of non-dividend payers.[28] Likewise, Amihud's illiquidity ratio (price impact) is 0.35 standard deviations lower for dividend payers compared to non-payers.

Table 3.7 The effect of dividend payment decisions on stock liquidity: pooled OLS regression model

This table presents the results of the pooled OLS regression of the effect of dividend payment decisions on stock liquidity. The dependent variable is stock liquidity and is measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. DIV is a dummy variable with a value of 1 if the stock is dividend-paying and a value of 0 if otherwise. Size is the firm size. Growth is the growth opportunities. Profitability is the firm profitability. Return is the firm stock return and Volatility is stock return volatility. See Table 3.2 for variables measurement. Year and industry dummies are included to control for year and industry effects. Numbers in parentheses represent t-values that are adjusted using standard errors corrected for heteroscedasticity and clustering at the firm level. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	Turnover	Spread	Amihud
DIV	-0.2141***	-0.3454***	-0.3498***
	(-3.47)	(-7.10)	(-6.09)
Size	0.4483***	-0.4976***	-0.2518***
	(13.49)	(-24.34)	(-13.40)
Growth	0.0029	-0.0829***	-0.1104***
	(0.19)	(-5.86)	(-5.80)
Profitability	-0.0516**	-0.1572***	-0.0567**
	(-2.27)	(-7.28)	(-2.47)
Return	-0.0162	-0.0753***	-0.0723***
	(-1.61)	(-6.31)	(-4.38)
Volatility	0.0195	0.0273	0.0097
	(0.98)	(1.60)	(0.56)
Intercept	-0.0744	0.4010***	0.2311***
	(-0.82)	(4.65)	(2.61)
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Observations	7739	7739	7739
F-statistic	21.90***	55.53***	11.99***
Adj. R-squared	0.2636	0.4699	0.1828

[28] Given that variables are standardized, the coefficient is interpreted as standard deviation changes in the dependent variable resulting from one standard deviation in the independent variable.

However, dividend payment decisions are found to have negative and significant impacts on turnover ratio. The coefficient on *DIV* is negative (-0.2141) and significant (t=3.47). This result does not support our prediction that dividend payment decisions improve trading activity, and it is consistent with the view that although institutions are more likely to buy dividend-paying stocks because of their preference for holding higher-yielding stocks, they tend to be more passive "buy and hold" investors (Hotchkiss and Lawrence 2007). Also, it is in line with the report of the International Organization of Securities' Commissions (IOSCO) Emerging Markets Committee (December 2007), which states that dividend policy should to be taken into account when evaluating a stock's liquidity and that stocks with high dividends tend to be bought and held by their investors and hence their transactions occur less frequently.

The coefficient estimates for the control variables are also mostly consistent with our expectations. The coefficient on stock *Returns* is negative and significant in the regressions where bid–ask spread and illiquidity ratio are used as the dependent variables. This is in line with the view that firms with lower market performance have less liquid stock (Gopalan et al. 2012; Charoenwong et al. 2014). We also show that *Size* is significantly and positively associated with turnover ratio, and significantly and negatively associated with both bid–ask spread and illiquidity ratio. This may reflect the fact that large firms are more likely to be followed by analysts and attract investors and hence experience a lower degree of information asymmetry than small ones (Kadapakkam et al. 1998). Moreover, a large firm is more able to disclose a lot of information thus reducing the level of information asymmetry and improving stock liquidity (Loukil et al. 2010). Our results are in line with the findings of many studies, including Chung et al. (2010), Gopalan et al. (2012), Poon et al. (2013), Prommin et al. (2014), and Hillert et al. (2016), who find that large firms tend to have higher levels of stock liquidity compared to small firms. *Growth* is significantly negatively related to bid–ask spread and illiquidity ratio suggesting that stock liquidity tends to be more valuable for firms with more growth opportunities. For example, Amihud and Mendelson (2012) argue that firms with high growth opportunities are more likely to follow ways to make their stock more liquid in order to reduce their cost of capital. Consistent results are found in Dass et al. (2011) and Gopalan et al. (2012). *Profitability* is negatively and significantly associated with bid–ask spread and illiquidity ratio. These results are in line with previous studies that show that more profitable firms and firms with better operating performance tend to have higher stock liquidity than their loss-making counterparts (Gopalan et al. 2012; Andres et al. 2014; Charoenwong et al. 2014).

3.6.3.2. The impact of the amount of dividend decision on stock liquidity

We now turn to estimate the impact of the amount of dividend decision on the level of stock liquidity using the sub-sample of dividend-paying stocks only. Table 3.8 shows the pooled OLS estimation results of our main model where the *HighDPS* dummy variable is used as a proxy for the amount of dividend decision. The results show that *HighDPS* has a negative impact on liquidity. The coefficients on *HighDPS* in regressions with the bid–ask spread and illiquidity ratio as the dependent variable are -0.0961 (t=-2.96) and -0.1382 (t=-4.11), respectively. This indicates that firms that pay a high amount of dividends are more liquid than those firms that pay a low amount of dividends, which is consistent with our second hypothesis (H2). These results are economically significant. The bid–ask spread and illiquidity ratio of firms that pay high dividends are, respectively, 0.096 and 0.138 standard deviations lower than those of firms that pay a low amount of dividends. These results are consistent with Howe and Lin (1992) who find that bid–ask spread is significantly negatively related to dividend amount.

With regards to the control variables, the results are generally in line with previous studies. The size of the firm has a positive and significant impact on stock liquidity, consistent with Chung et al. (2010), Gopalan et al. (2012), Poon et al. (2013), Prommin et al. (2014), and Hillert et al. (2016). As expected, the profitability variable has a significantly positive impact on the turnover ratio but a significantly negative impact on both bid–ask spread and illiquidity ratio, indicating that firms with better operating performance have higher stock liquidity (Gopalan et al. 2012; Andres et al. 2014; Charoenwong et al. 2014). The growth opportunities variable has a significant and positive effect on stock liquidity, in line with Amihud and Mendelson (2012). Stocks with higher return have higher stock liquidity, consistent with Gopalan et al. (2012), Andres et al. (2014), and Charoenwong et al. (2014).

Table 3.8 The impact of the amount of dividends decision (HighDPS) on stock liquidity: pooled OLS regression model

This table presents the results of the pooled OLS regression of the effect of the amount of dividends decision on stock liquidity. The dependent variable is stock liquidity and is measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. HighDPS is a dummy variable with a value of 1 with observations above the median DPS and 0 otherwise. Size is the firm size. Growth is the growth opportunities. Profitability is the firm profitability. Return is the firm stock return and Volatility is stock return volatility. See Table 3.2 for variables measurement. Year and industry dummies are included to control for year and industry effects. Numbers in parentheses represent t-values that are adjusted using standard errors corrected for heteroscedasticity and clustering at the firm level. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	Turnover	Spread	Amihud
HighDPS	0.0663	-0.0961***	-0.1382***
	(1.47)	(-2.96)	(-4.11)
Size	0.4416***	-0.5896***	-0.3649***
	(12.24)	(-23.79)	(-14.90)
Growth	-0.0198	-0.0480***	-0.0912***
	(-1.41)	(-3.67)	(-6.32)
Profitability	0.0499**	-0.1961***	-0.1405***
	(2.15)	(-11.63)	(-7.67)
Return	-0.0112	-0.0696***	-0.0474***
	(-0.90)	(-5.96)	(-2.99)
Volatility	0.0271	0.0014	-0.0197
	(1.43)	(0.09)	(-1.27)
Intercept	-0.3608***	0.2989***	-0.0001
	(-3.62)	(3.48)	(0.00)
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Observations	5713	5713	5713
F-statistic	22.49***	45.40***	12.58***
Adj. R-squared	0.3275	0.4897	0.2376

We further investigate the effect of the amount of dividend payment on stock liquidity by regressing stock liquidity measures on a continuous dividend variable measured by the dividend per share (*DPS*). Table 3.9 shows that the coefficient on *DPS* is significantly negative with respect to both bid-ask spread and illiquidity ratio. This indicates that firms that pay a high amount of dividends are more liquid than those firms that pay a low amount of dividends, which is consistent with our second hypothesis (H2). In terms of economic significance, the results suggest that a one standard deviation increases in dividend per share results in 0.016 and 0.022 standard deviations decrease in bid–ask spread and illiquidity ratio, respectively.

Table 3.9 The impact of the amount of dividends decision (DPS) on stock liquidity: pooled OLS regression model

This table presents the results of the pooled OLS regression of the effect of the amount of dividends decision on stock liquidity. The dependent variable is stock liquidity and is measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. DPS is a continuous variable measured as the dividend per share. Size is the firm size. Growth is the growth opportunities. Profitability is the firm profitability. Return is the firm stock return and Volatility is stock return volatility. See Table 3.2 for variables measurement. Year and industry dummies are included to control for year and industry effects. Numbers in parentheses represent t-values that are adjusted using standard errors corrected for heteroscedasticity and clustering at the firm level. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	Turnover	Spread	Amihud
DPS	-0.0201	-0.0155***	-0.0221*
	(-0.69)	(-2.94)	(-1.98)
Size	0.4348***	-0.5374***	-0.2779***
	(14.19)	(-24.69)	(-13.49)
Growth	0.0053	-0.0773***	-0.1061***
	(0.35)	(-5.42)	(-5.51)
Profitability	-0.0838***	-0.2156***	-0.1108***
	(-3.82)	(-11.21)	(-5.14)
Return	-0.0156	-0.0735***	-0.0712***
	(-1.56)	(-6.05)	(-4.26)
Volatility	0.0280	0.0418**	0.0237
	(1.40)	(2.30)	(1.30)
Intercept	-0.23287***	0.14759*	-0.02736
	(-2.92)	(1.92)	(-0.36)
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Observations	7739	7739	7739
F-statistic	22.20***	55.49***	11.44***
Adj. R-squared	0.2585	0.4564	0.1695

Using a subsample discards part of the information contained in the non-paying firms. To account for this, we conduct a regression with both *DIV* that separates payers (low and high) from non-payers and *HighDPS* separates high payers from both low and non-payers using the full sample. The results are reported in Table 3.10. The results continue to hold. Stock liquidity is found to be positively related to whether the stock is dividend payer or not as well as to have positive relationship with the amount of dividends. The coefficients on *DIV* and *HighDPS* are negative with respect to both *Spread* and *Amihud*.

Table 3.10 The impact of both dividend payment (DIV) and amount of dividends decisions (HighDPS) on stock liquidity: pooled OLS regression model

This table presents the results of the pooled OLS regression of the effect of both dividend payment decision and the amount of dividends decision on stock liquidity. The dependent variable is stock liquidity and is measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. DIV is a dummy variable with a value of 1 if the stock is dividend-paying and a value of 0 if otherwise. HighDPS is a dummy variable with a value of 1 with observations above the median DPS and 0 otherwise. Size is the firm size. Growth is the growth opportunities. Profitability is the firm profitability. Return is the firm stock return and Volatility is stock return volatility. See Table 3.2 for variables measurement. Year and industry dummies are included to control for year and industry effects. Numbers in parentheses represent t-values that are adjusted using standard errors corrected for heteroscedasticity and clustering at the firm level. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	Turnover	Spread	Amihud
DIV	-0.2306***	-0.2946***	-0.2796***
	(-3.71)	(-5.66)	(-4.66)
HighDPS	0.0339	-0.1041***	-0.1439***
	(0.82)	(-3.52)	(-4.84)
Size	0.4441***	-0.4846***	-0.2338***
	(13.23)	(-23.60)	(-12.76)
Growth	0.0039	-0.0860***	-0.1146***
	(0.26)	(-6.06)	(-5.98)
Profitability	-0.0529**	-0.1532***	-0.0511**
	(-2.31)	(-7.63)	(-2.23)
Return	-0.0160	-0.0758***	-0.0730***
	(-1.60)	(-6.35)	(-4.43)
Volatility	0.0201	0.0257	0.0074
	(1.01)	(1.50)	(0.43)
Intercept	-0.0795	0.4165***	0.2525***
	(-0.87)	(4.84)	(2.83)
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Observations	7739	7739	7739
F-statistic	21.24***	54.05***	11.68***
Adj R-squared	0.2636	0.4714	0.1855

3.6.4. Robustness checks

3.6.4.1. Endogeneity issues

The analysis of the impact of dividend policy decisions on stock liquidity is not straightforward, because dividend decisions are not randomly determined (Li and Prabhala 2005; Khang and King 2006; Turkiela 2014), and they may be affected by factors that are also related to stock liquidity, suggesting that stock liquidity itself may impact the decision to pay (see, e.g., Banerjee et al. 2007; Griffin 2010; Kuo et al. 2013). In the existing literature on the relationship between corporate finance and stock liquidity, different studies regard the endogeneity issue as the most important concern (see, e.g., Rubin 2007; Lipson and Mortal 2009; Poon et al. 2013). In fact, Amihud and Mendelson (1986) suggest that a variety of financing decisions could be influenced by liquidity effects. Therefore, it seems worthwhile to investigate whether endogeneity is a cause for concern.

Roberts and Whited (2012) point out that the endogeneity problem mainly results from two sources: unobservable heterogeneity and simultaneity. On the one hand, unobservable heterogeneity, also known as omitted variables, occurs when the relationship between two or more variables in the regression model is influenced by other variables that should be included in the vector of explanatory variables, but for various reasons are not (Roberts and Whited 2012). If there is a correlation between these omitted variables and other variables in the model, in this case we are dealing with an endogeneity problem in our regression model (Hsiao 2003). In the dividend policy–liquidity relationship, firm-specific characteristics – also known as firm-fixed effects– could influence dividend policy variables, but are unobservable and difficult to measure. We argue that the decisions of the firm's management regarding dividends are not exogenous (Khang and King 2006; Turkiela 2014); rather, they can be affected by variables that are also related to stock liquidity. Hence, dividend-paying firms (or payers of high dividends) and non-paying firms (or payers of low dividends) may have different characteristics. If this is the case, a simple comparison between stock liquidity of dividend-paying firms (or payers of high dividends) and non-paying firms (or payers of low dividends) will be biased.

On the other hand, simultaneity arises when the dependent variable and one or more of the explanatory ones are jointly determined. In this case, the first variable causes the other(s), and the reverse is true (Roberts and Whited 2012).[29] Previous literature on dividend policy has found a causal relation between stock liquidity and dividends. Many studies document a negative association between stock market liquidity and dividend payment decision. Many studies, including Banerjee et al. (2007), Kuo et al. (2013), and Alphonse and Tran (2014), show that stock liquidity has a significant effect on dividend policy and that firms with more (less) stock liquidity are less (more) likely to pay dividends. This suggests that relationship may run from stock liquidity to dividend policy.

Using lagged independent variables[30] and the inclusion of year and industries dummies[31] in our main model mitigate but do not eliminate endogeneity. To further control for endogeneity, we adopt two additional models: a two-stage regression approach and firm fixed-effects model.

Two-stage regression approach[32]

This approach allows the recovery of causal estimates in the presence of non-random assignment to treatment. In the first stage, the probability of being selected in the treatment group is estimated from exogenous instruments. In the second stage, the main model is estimated by adding a

[29] According to Gujarati (2004:753-754), a "simultaneity problem arises because some of the regressors are endogenous and are therefore likely to be correlated with the disturbance, or error term".
[30] Many previous finance studies use the lagged independent variables to control for endogeneity; see for example, Brockman et al. (2009) and Gopalan et al. (2012).
[31] For example, Poon et al. (2013) use industry and firm fixed-effect specifications to account for omitted variables in the relationship between institutional ownership and liquidity. They state that "To alleviate concerns about endogeneity and spurious inferences, in addition to including the control variables that the literature identifies as important determinants of market liquidity, all model specifications include industry fixed effects to control for time-invariant omitted industry-level factors that affect liquidity. We also include year effects to control for cross-sectional dependence, that is, market-wide factors that affect a stock's market liquidity" (p.93).
[32] See Gul et al. (2010) for a similar approach in the context of audit quality and price synchronicity and Fernandes and Ferreira (2008) in the context of cross listing and stock price informativeness.

control variable that captures the difference between treatment and control group resulting from unmodelled sources of variance in the selection process. Therefore, the correlation between the error term and selection is removed, and consistent estimators can be obtained (see Antonakis et al. 2014).

The first stage of this estimation method estimates the likelihood of a firm paying dividends (or high dividends) given firm characteristics:

$$Probability\ (Dividend\ policy_{i,t}) = f\ (\delta Z_{it}) \quad (3.2)$$

where $Dividend\ policy$ is the dividend policy variable measured by (1) DIV_{it} which is the dividend paying dummy variable with a value of 1 if the stock is dividend-paying in year t and 0 otherwise and (2) $HighDPS_{i,t}$ which is the amount of dividend dummy variable with a value of 1 if the stock has a *DPS* in year *t* above the median and 0 otherwise. Z_{it} are the control variables in addition to an instrumental variable. As an instrumental variable for the $\mathrm{Dividend\ policy}$ dummy, we use the industry-median dividend per share. We believe that this may be a valid instrument because an industry-level dividend may affect the dividend decisions of a given firm within that industry, but it is unlikely to have a direct impact on this firm's stock liquidity.[33] We include all the exogenous regressors along with this instrument. Year and industry dummies are included to control for year and industry fixed effects.

In the second stage, we estimate our main regressions in two different ways to deal with potential endogeneity biases arising from the fact that dividend policy decisions are endogenously determined and that some potential determinants affect both dividend policy and stock liquidity. First, we conduct an instrumental variable (IV) regression in which we estimate our main regressions with the fitted value of $Dividend\ policy$ which are the estimated probability of Dividend policy from the first-stage probit regression (Equation 3.2) as an instrument for the dividend policy decision variable in the main model. Second, we follow the Heckman (1979) two-stage treatment effect

[33] Similar studies that use industry-level variables as instruments are Jiraporn et al. (2011) and Kini and Williams (2012).

procedure.[34] More specifically, the coefficient estimates from the probit model are used to compute the Inverse Mills Ratios (*IMR*s) (λ_{it}),[35] which are the probability density function divided by the cumulative distribution function of a distribution, for each observation in the sample:

$$\text{for } Dividend\ policy_{i,t} = 1,\ \lambda_{it} = \frac{\phi(\delta Z_{it})}{\Theta(\delta Z_{it})} \quad (3.3)$$

$$\text{for } Dividend\ policy_{i,t} = 0,\ \lambda_{it} = -\frac{\phi(\delta Z_{it})}{1-\Theta(\delta Z_{it})} \quad (3.4)$$

λ_{it} is the *IMR*; ϕ is the standard normal probability density function; and Θ is the cumulative distribution of the standard normal function. Then we estimate our main model while including the estimated *IMR*s to account for the endogeneity bias and get reliable parameter estimates.

Table 3.11 presents the results of the two-stage regressions for the decision to pay dividends (*DIV*). Column (1) reports the probit estimates of the first stage. The industry–dividend median variable is positively and statistically significant, indicating that the higher the level of dividend per share within a particular industry, the more likely firms are to pay dividends.[36] In Column (2), we report the second-stage results. Panel A reports second-stage results from IV regression with predicted value of *DIV* included,[37] while Panel B presents those from the Heckman model with the *IMR* included. Both Panels

[34] The description ''Heckman's two-stage procedure'' may make some confusion with the Heckman's sample selection correction. In the thesis we do not use the Heckman's sample selection model as we have stock liquidity information for both dividend payers and non-payers. The aim of sample selection corrections is different from that of treatment effect. For the sample selection problem, the aim is to estimate β. However, in estimating an average treatment effect we are interested in the causal effect that dividend decisions (DIV/HighDPS) has on stock liquidity. See Guo and Fraser (2015) for more details about the difference between these two procedures and Campa and Kedia (2002) for an application of the procedure in the context of diversification

[35] The *IMR* is an estimate of the non-selection hazard that addresses the probability of a stock with characteristics Z_{it} being a dividend payer.

[36] To test the validity of our instrument, we look at the first stage (see Larcker and Rusticus (2010: 192) and Antonakis et al. (2014: 32)). The first-stage F-tests that the instruments are jointly zero exceed critical value for a weak instrument (F=8.96 for the case with one instrument) as developed in Stock et al. (2002). Moreover, our instrument is highly significant in the first stage OLS regressions with a t-statistic of 3.20 and 3.49 for *DIV* and *HighDPS*, respectively. These alleviate the concern that our estimation suffers from bias introduced by having weak instruments.

[37] This was carried out using the treatreg command in STATA 13 since the endogenous variable is a dummy. The treatment regression considers the effect of an endogenously chosen binary treatment on another endogenous continuous variable (Cong and Drukker 2001).

involve the three stock liquidity measures. As shown in both Panels, results continue to hold. Consistent with H1, the coefficients on *DIV* are significantly negative, at varying levels of statistical significance. The dividend-paying firms have lower bid–ask spread and lower illiquidity ratio and hence higher stock liquidity. However, the dividend-paying firms are found to have lower turnover ratio, suggesting that dividends may decrease liquidity on some dimensions. This result is consistent with the view that stocks of dividend-paying firms may be purchased and hold by investors (Hotchkiss and Lawrence 2007; IOSCO Emerging Markets Committee December 2007).

Table 3.12 represents the results of the two-stage regressions for the amount of dividend decision (*HighDPS*). The first-stage regression results are in Column (1) and the second-stage regressions are in Column (2). The results of Column (1) show that the industry–dividend median variable is positively and statistically significant. This result indicates that the higher the level of dividend per share within a particular industry, the more likely firms are to pay high dividends. Column (2) shows that payers of high dividends have a significantly higher stock liquidity than payers of low dividends.

Table 3.11 The effect of dividend payment decision on stock liquidity: two-stage regressions

This table reports the results of two-stage regressions in which the DIV dummy variable, which takes the value of 1 for dividend-paying stocks and 0 otherwise, is assumed to be endogenous. Columns (1) and (2) report the first- and second-stage regression results, respectively. The first-stage regression is a probit regression with the DIV dummy being the dependent variable. We instrument for this variable using the industry-median DPS variable. Panel A reports the results from the IV approach, and Panel B reports the results from the Heckman approach. The dependent variable is stock liquidity and measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio All of these variables are calculated as the averages of daily values over a particular year. IMR is the inverse Mills ratio in the Heckman model. The other variables are defined in Table 3.2. Year and industry dummies are included to control for year and industry effects. T-statistics are reported in parentheses. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	First stage	Second stage					
	(1)	(2)					
		Panel A: IV approach with the predicted DIV			Panel B: Heckman approach with inverse Mills ratio included		
		Turnover	Spread	Amihud	Turnover	Spread	Amihud
DIV		-0.2795**	-0.4600***	-0.4983***	-0.2853	-0.7873***	-1.1217***
		(-2.45)	(-10.17)	(-10.33)	(-1.44)	(-4.65)	(-5.53)
Size	0.4553***	0.4454***	-0.5075***	-0.2501***	0.4460***	-0.4741***	-0.1866***
	(19.35)	(28.35)	(-53.36)	(-23.76)	(12.88)	(-20.68)	(-8.82)
Growth	-0.0678***	-0.0555***	-0.0850***	-0.1075***	-0.0556***	-0.0896***	-0.1164***
	(-2.98)	(-4.34)	(-7.91)	(-7.79)	(-3.58)	(-6.48)	(-6.97)
Profitability	0.7505***	-0.0434*	-0.1466***	-0.0509***	-0.0424	-0.0926***	0.0519
	(18.21)	(-1.80)	(-9.23)	(-2.67)	(-1.08)	(-2.66)	(1.30)
Return	-0.0259	0.0080	-0.0164*	-0.0279**	0.0079	-0.0177*	-0.0304***
	(-1.37)	(0.68)	(-1.73)	(-2.36)	(0.76)	(-1.93)	(-2.64)
Volatility	-0.1722***	0.0449***	0.0431***	0.0325**	0.0447**	0.0305*	0.0084
	(-9.21)	(3.69)	(4.23)	(2.40)	(2.13)	(1.90)	(0.50)
Industry-median DPS	0.3103***						
	(3.20)						
IMR					0.0169	0.2543***	0.4428***
					(0.14)	(2.76)	(4.17)
Intercept	0.8259***	-0.1167	0.3705***	0.2819***	-0.1124	0.6136***	0.7448***
	(8.59)	(-1.23)	(6.88)	(4.38)	(-0.69)	(4.10)	(4.33)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8780	8780	8780	8780	8780	8780	8780
F/Chi2	1492.9***	2334.91***	5193.41***	783.75***	22.33***	57.88***	12.40***
Pseudo R2/R2	0.3466				0.2682	0.5035	0.2127

Table 3.12 The effect of the amount of dividend decision on stock liquidity: two-stage regressions

This table reports the results of two-stage regressions in which the HighDPS dummy variable, which takes the value of 1 for observations with above the median DPS and 0 otherwise, is assumed to be endogenous. Columns (1) and (2) report the first- and second-stage regression results, respectively. The first-stage regression is a probit regression with the HighDPS dummy being the dependent variable. We instrument for this variable using the industry-median DPS variable. Panel A reports the results from the IV approach, and Panel B reports the results from the Heckman approach. The dependent variable is stock liquidity and measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. IMR is the inverse Mills ratio in the Heckman model. The other variables are defined in Table 3.2. Year and industry dummies are included to control for year and industry effects. T-statistics are reported in parentheses. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	First stage	Second stage					
	(1)	(2)					
		IV approach with the predicted DIV			Heckman approach with inverse Mills ratio included		
		Turnover	Spread	Amihud	Turnover	Spread	Amihud
HighDPS		0.8385***	-0.7000***	-0.4719***	3.2060***	-2.2422***	-1.3222***
		(12.89)	(-15.29)	(-14.19)	(6.98)	(-5.76)	(-3.08)
Size	0.5741***	0.2738***	-0.4993***	-0.3273***	-0.1671*	-0.2121***	-0.1690**
	(29.35)	(16.17)	(-37.49)	(-27.30)	(-1.79)	(-2.71)	(-1.94)
Growth	-0.0719***	-0.0707***	-0.0730***	-0.0855***	-0.0087	-0.1135***	-0.1077***
	(-3.88)	(-5.17)	(-7.09)	(-7.30)	(-0.48)	(-7.84)	(-6.59)
Profitability	0.3182***	-0.0539***	-0.1702***	-0.1404***	-0.2953***	-0.0129	-0.0537
	(15.74)	(-3.63)	(-14.71)	(-10.77)	(-5.70)	(-0.29)	(-1.11)
Return	-0.0281	-0.0019	-0.0296***	-0.0343**	0.0195*	-0.0435***	-0.0420***
	(-1.52)	(-0.14)	(-2.77)	(-2.53)	(1.65)	(-4.27)	(-3.35)
Volatility	-0.0415**	0.0622***	0.0027	-0.0085	0.0928***	-0.0172	-0.0195
	(-2.24)	(4.92)	(0.26)	(-0.63)	(4.92)	(-1.11)	(-1.11)
Industry-Median DPS	0.3622***						
	(3.49)						
IMR					-1.9360***	1.2748***	0.7171***
					(-6.98)	(5.44)	(2.78)
Intercept	-0.7464***	-0.6922***	0.4042***	0.1240**	-1.59921***	0.9951***	0.4498**
	(-5.84)	(-12.21)	(7.96)	(2.43)	(-8.21)	(-5.94)	(2.55)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6596	6596	6596	6596	6596	6596	6596
F/Chi2	1240.59***	2047.2***	5193.41***	977.72***	22.92***	63.22***	15.51***
Pseudo R2/R2	0.1723				0.3451	0.5321	0.2612

Firm fixed-effects model[38]

We further address the endogeneity concern using the firm fixed-effects regression which allows controlling for unobserved heterogeneity due to time-invariant omitted variables that are constant over time but differ across firms. Brooks (2008) and Li and Prabhala (2005) show that panel regressions with firm fixed effects can control for endogeneity stemming from unobserved attributes that are fixed over time. Table 3.13 presents the estimation results of firm fixed-effect regression.[39] In Panel A, we find again that trading cost (*Spread*) and price impact (*Amihud*) are negatively and significantly related to *DIV*, while trading activity (*Turnover*) is positively but not significantly related to *DIV*. These results suggest that stock liquidity improves with payment of dividends. Panel B shows that *HighDPS* is negatively related to trading costs (*Spread*) but positively related to trading activity (*Turnover*). These results are significant at the 10% level, providing further evidence that amount of dividend decision has a positive impact on stock liquidity.

Overall, our finding that dividend payers (payers of high dividends) have higher liquidity than non-payers (payers of low dividends) is further robust with regard to endogeneity concerns resulting from unobserved heterogeneity and reverse causality.

[38] Roberts and Whited (2012) argue that one of the most common causes of endogeneity in empirical corporate finance is omitted variables, and omitted variables are a problem because of the considerable heterogeneity present in many empirical corporate finance settings. Many previous finance studies use firm fixed effects to control for endogeneity including Jiraporn et al. (2011), Ferreira et al. (2011), Chang et al. (2015), Ben-Nasr and Alshwer (2016), and Firth et al. (2016).

[39] To choose between random effect and fixed effect, we perform the Hausman test. The untabulated results confirm the appropriateness of fixed effect.

Table 3.13 The effect of dividend policy decisions on stock liquidity: fixed-effects regressions

This table reports the results of the fixed-effects regression. Panel A reports the results for the dividend payment decision, and Panel B reports the results for amount of dividend decision. DIV is a dummy variable that takes the value of 1 for dividend-paying stocks and 0 otherwise. HighDPS is a dummy variable that takes the value of 1 for stocks with above the median DPS and 0 otherwise. The dependent variable is stock liquidity and measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. The other variables are defined in Table 3.2. Year dummies are included to control for year effects. T-statistics are reported in parentheses. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	Panel A: Dividend payment decision				Panel B: Amount of dividend decision		
	Turnover	Spread	Amihud		Turnover	Spread	Amihud
DIV	0.0664	-0.3241***	-0.2908***	HighDPS	0.0803*	-0.0669*	-0.0348
	(1.29)	(-6.18)	(-3.64)		(1.90)	(-1.92)	(-0.83)
Size	0.5232***	-0.3660***	-0.4004***	Size	0.5581***	-0.2931***	-0.2979***
	(8.80)	(-6.99)	(-5.13)		(7.96)	(-4.44)	(-4.16)
Growth	0.0047	-0.0361***	-0.0461**	Growth	-0.0083	-0.0196*	-0.0542***
	(0.36)	(-2.62)	(-2.46)		(-0.72)	(-1.90)	(-4.55)
Profitability	-0.0537**	-0.1089***	-0.0316	Profitability	0.0100	-0.0881***	-0.0770***
	(-2.54)	(-4.68)	(-1.11)		(0.72)	(-5.09)	(-3.66)
Return	-0.0102	-0.0586***	-0.0707***	Return	-0.0060	-0.0457***	-0.0502***
	(-1.14)	(-5.40)	(-4.16)		(-0.57)	(-4.04)	(-2.99)
Volatility	0.0247*	-0.0069	-0.0502**	Volatility	0.0308**	-0.0088	-0.0548***
	(1.84)	(-0.49)	(-2.41)		(2.21)	(-0.69)	(-3.14)
Intercept	-0.1743***	0.2611***	0.0410	Intercept	-0.2366***	0.0928**	-0.1471***
	(-2.99)	(4.29)	(0.45)		(-4.79)	(1.97)	(-3.18)
Year effects	Yes	Yes	Yes	Year effects	Yes	Yes	Yes
Observations	7739	7739	7739	Observations	5713	5713	5713
F-statistic	24.85***	29.75***	11.45***	F-statistic	26.91***	28.27***	9.37***
Adj. R-squared	0.2469	0.1893	0.1095	Adj. R-squared	0.3288	0.2173	0.1302

3.6.4.2. Effect of firm size

As a robustness check, we examine whether the relationship between dividend policy decisions and stock liquidity varies according to firm size. In fact, this check allows us to determine whether the nature of the relationship between stock liquidity and dividend policy depends on the level of asymmetric information. By doing this, we can provide further evidence consistent with the arguments based on asymmetric information.[40] Large firms have lower information asymmetry than smaller firms and hence higher stock liquidity due to their access to capital markets (Anderson and Fraser 2000). Additionally, larger firms, on average, release more information than smaller firms (Loukil et al. 2010) and have more analyst following and are thus subject to more scrutiny by the investment community than smaller firms (Brennan and Subrahmanyam 1996; Riahi et al. 2013). We expect that the effect of dividend policy on stock liquidity varies with the size of the firm.

We consider sub-samples of firms according to firm size by constructing a dummy variable (*Large*) which takes the value of 1 for observations with above the median size and 0 otherwise. Table 3.14 presents the results for models using the *Large* dummy variable and its interaction term with the *DIV/HighDPS* dummy. We expect small firms to have greater information problems and thus to have less stock liquidity. Panel A of Table 3.14 shows that the *DIV* dummy variable continues to have a negative and significant effect on bid–ask spread and illiquidity ratio, in line with our earlier findings. While Large is significantly negative, its interaction term with the *DIV* dummy is significantly positive. Consistent with our conjecture, this finding suggests that small firms have a higher bid–ask spread and illiquidity ratio than their large counterparts. Further, within the group of small firms, those that are non-dividends payers have more bid–ask spread and illiquidity ratio than those that are dividends payers. Panel B of Table 3.14 shows that the coefficient on *HighDPS* dummy variable remains statistically negative with respect to bid–ask spread and illiquidity ratio, consistent with our earlier

[40] Firm size has been used widely in finance research as a proxy for the level of asymmetric information (see, e.g., Bharath et al. 2009; Leary and Michaely 2011).

findings. Furthermore, small firms have a higher bid–ask spread and illiquidity ratio than their large counterparts. Further, within the group of small firms, those that are low-dividend payers have more bid–ask spread and illiquidity ratio than those that are high-dividend payers. Put together, our results suggest that the impact of dividend policy decisions on stock liquidity varies with the firm size.

Considering that large firms are associated with lower levels of asymmetric information than small firms, our finding is in line with the argument based on asymmetric information. Overall, our results suggest the difference in the level of stock liquidity of dividend-payer and non-payer firms as well as high-dividend payers and low-dividend payers varies with the levels of informational asymmetries facing these firms.

Table 3.14 The effect of dividend policy decisions on stock liquidity: impact of firm size

This table presents the impact of firm size on the effect of dividend policy decisions on stock liquidity. The dependent variable is stock liquidity and measured by the following: (1) Turnover is the turnover rate, (2) Spread denotes the proportional quoted bid–ask spread and (3) Amihud is the Amihud (2002) illiquidity ratio. All of these variables are calculated as the averages of daily values over a particular year. Large is a dummy variable that takes the value of 1 for observations with above the median size, and 0 otherwise. Panel A reports the results for the dividend payment decision, and Panel B reports the results for amount of dividend decision. DIV is a dummy variable that takes the value of 1 for dividend-paying stocks and 0 otherwise. HighDPS is a dummy variable that takes the value of 1 for observations with above the median DPS and 0 otherwise. The other variables are defined in Table 3.2. Year and industry dummies are included to control for year and industry effects. Numbers in parentheses represent t-values that are adjusted using standard errors corrected for heteroscedasticity and clustering at the firm level. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

	Panel A: Dividend payment decision				Panel B: Amount of dividend decision		
	Turnover	Spread	Amihud		Turnover	Spread	Amihud
DIV	-0.1931***	-0.5069***	-0.5381***	HighDPS	0.0066	-0.2060***	-0.3096***
	(-3.42)	(-7.87)	(-6.72)		(0.14)	(-3.76)	(-5.34)
Large	0.3893***	-0.7913***	-0.7342***	Large	0.4304***	-0.5395***	-0.5218***
	(3.04)	(-10.64)	(-9.63)		(5.13)	(-10.34)	(-8.71)
Large*DIV	-0.0736	0.4494***	0.5139***	Large*HighDPS	0.1067	0.2193***	0.3364***
	(-0.60)	(5.91)	(6.79)		(1.36)	(3.68)	(5.33)
Size	0.3229***	-0.3358***	-0.1318***	Size	0.2503***	-0.4253***	-0.2325***
	(7.38)	(-14.14)	(-5.72)		(4.99)	(-14.69)	(-8.26)
Growth	-0.0027	-0.0741***	-0.1029***	Growth	-0.0229*	-0.0445***	-0.0879***
	(-0.18)	(-5.40)	(-5.58)		(-1.68)	(-3.46)	(-6.24)
Profitability	-0.0494**	-0.1473***	-0.0429*	Profitability	0.0528**	-0.1940***	-0.1365***
	(-2.23)	(-7.38)	(-1.86)		(2.38)	(-11.85)	(-7.65)
Return	-0.0195*	-0.0707***	-0.0687***	Return	-0.0124	-0.0691***	-0.0472***
	(-1.95)	(-6.12)	(-4.22)		(-1.00)	(-6.03)	(-2.98)
Volatility	0.0228	0.0215	0.0046	Volatility	0.0316*	-0.0020***	-0.0221
	(1.16)	(1.32)	(0.27)		(1.66)	(-0.13)	(-1.47)
Intercept	-0.2678***	0.7388***	0.5266***	Intercept	-0.5882***	0.5458***	0.2252***
	(-2.83)	(8.56)	(5.55)		(-5.97)	(6.45)	(3.52)
Year effects	Yes	Yes	Yes	Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Industry effects	Yes	Yes	Yes
Observations	7739	7739	7739	Observations	5713	5713	5713
F-statistic	22.34***	72.23***	13.91***	F-statistic	23.37***	63.23***	15.36***
Adj. R-squared	0.2741	0.4938	0.2003	Adj. R-squared	0.3492	0.5112	0.2571

3.7. Conclusion

In this chapter, we examine the impact of dividend policy, specifically how the firm's dividend policy decisions affect stock liquidity. We hypothesize that dividend policy decisions result in higher stock liquidity as they lead to lower levels of asymmetric information. Our analysis yields the following results:

First, the univariate analysis shows that dividend-paying and non-dividend-paying stocks tend to have significant differences in their levels of stock liquidity. More specifically, dividend-paying stocks tend to have lower bid–ask spreads and lower illiquidity ratios. However, dividend-paying stocks have lower turnover ratio. Similarly, stocks of high-dividend-paying firms are significantly more liquid than those of low-dividend-paying firms.

Second, after controlling for other factors that potentially affect stock liquidity, the results of the multivariate analysis show that stocks of dividend payers exhibit significantly lower bid–ask spread and illiquidity ratio than their non-dividend payer counterparts. This evidence implies that stock liquidity is affected by whether or not a firm pays dividends. Similar results are found for high-dividend-paying stocks. More specifically, stocks that pay high dividends tend to have higher stock liquidity compared to those stocks that pay low dividends. These findings are in line with the predictions of the asymmetric information hypothesis of Bhattacharya (1979) and Miller and Rock (1985), which posits that paying dividends signals information to the market and hence decreases the level of information asymmetry leading to higher stock liquidity. These findings are also consistent with the model of Easterbrook (1984), which suggests that dividend-paying firms are more likely to visit the capital market leading to more monitoring and hence more information being released to the market. Our findings are also consistent with those of Howe and Lin (1992), who find that dividend-paying stocks have lower bid–ask spreads than non-paying stocks, and with those of Mitra and Rashid (1997), who provide evidence of lower bid–ask spreads following dividend initiations.

However, contradictory to our hypothesis that payment of dividend should result in higher trading activity as dividend-paying firms are more favourable to large investors such as institutional investors (Allen et al. 2000; Grinstein and Michaely 2005) which have the ability to trade in large quantities (Rubin 2007), we find a significantly negative association between stock turnover and dividend payments. This is consistent with the view that although institutions are more likely to buy dividend-paying stocks because of their preference for holding higher-yielding stocks, they tend to be more passive "buy and hold" investors and they are less subject to pressures based on short-term performance measures (Hotchkiss and Lawrence 2007). Also, it is in line with the report of the International Organization of Securities Commissions (IOSCO) Emerging Markets Committee (December 2007) which states that dividend policy should be taken into account when evaluating a stock's liquidity and that stocks with high dividends tend to be bought and held by their investors and hence their transactions occur less frequently. This evidence suggests that the higher liquidity of dividend-paying firms comes primarily from the reduction in trading costs of those firms rather than from an increase in the trading activity of their stocks.

These findings are robust to alternative estimation methods and model specifications. We also find that the impact of being a dividend payer (high-dividend payer) on stock liquidity varies with the size of the firm, which is consistent with the argument based on asymmetric information. Our results thus show that the relationship between dividend policy decisions and stock liquidity varies with the degrees of asymmetric information facing these firms.

Overall, the findings of this chapter show that the dividend policy of UK firms can have a significant impact on the different liquidity aspects of their stocks. Moreover, these findings should be of considerable importance to both companies and investors. From the perspective of the firm, stock liquidity directly affects trading costs which, in turn, have an effect on the firm's cost of equity capital. The results suggest that dividend policy could enhance firm value through its effect on stock liquidity. From the investors' perspective, such findings suggest that they could trade the stocks of dividend payers and payers of high dividends at a lower transaction cost.

Chapter 4: Dividend Policy and Systematic Liquidity Risk

4.1. Introduction

A primary area of research in the field of corporate finance centres on the relationship between dividend policy and firm value. The positive value effects of dividend policy decisions are well documented in the literature. For example, many studies find strong evidence that dividend increases can result in positive abnormal returns (Abeyratna et al. 1996; McCluskey et al. 2006; Al-Yahyaee et al. 2011) and positive abnormal volume (Gurgul et al. 2003; Bozos et al. 2011; Dasilas and Leventis 2011). In recent decades, risk has become an important factor in explaining the well-known value effects of payout policies (Grullon et al. 2002; Eije et al. 2014). According to Eije et al. (2014), changes in risk levels may constitute a major channel through which dividend policy influences firm value. The risk-based explanation is corroborated by empirical observations that dividend payments are correlated with lower risk (Pástor and Pietro 2003; Bartram et al. 2012) and that payout policies may impact firm systematic risks (Grullon et al. 2002). Furthermore, by conducting a survey, Brav et al. (2005) find that managers tend to believe that there is a causal relation between higher dividends and risk reductions. We build on this literature and examine the effect of dividend policy on systematic liquidity risk, a type of risk that has been shown to be priced both in the USA and across the world (e.g., Acharya and Pedersen 2005; Lee 2011; Li et al. 2014; Ho and Chang 2015).

Existing literature provides various explanations for the relationship between dividend policy and liquidity risk. First, several studies show that dividend payments are associated with higher stock liquidity. For example, it has been documented that stocks of dividend payers have lower bid–ask spread than their non-payer counterparts (Howe and Lin 1992) and that the spread declines following dividend increase (Mitra and Rashid 1997). In a similar vein, Gurgul et al. (2003) and Dasilas and Leventis (2011) find that trading volume increases following dividend increases.

Numerous early studies, such as Amihud and Mendelson (1986) and Chalmers and Kadlec (1998), find a positive relationship between individual stock liquidity and stock returns and that liquidity is a source of non-diversifiable risk that should be reflected in expected asset returns (see, e.g., Chordia et al. 2000; Hasbrouck and Seppi 2001; Huberman and Halka 2001; Brockman and Chung 2002). Hence, motivated by the latest development in the liquidity literature, we argue that given that liquidity is priced, a higher (lower) liquidity associated with dividend policy decisions may result in lower (higher) liquidity risks leading to lower (higher) cost of equity. We hypothesize that non-dividend-paying firms will have a higher liquidity risk than their dividend-paying counterparts. Similarly, low-dividend-paying firms will have a higher liquidity risk than high-dividend-paying firms.

Second, it has been argued that when market liquidity declines, there is a decline in the demand of investors for stocks with greater adverse selection and uncertainty (Chordia et al. 2000; Pástor and Stambaugh 2003; Brunnermeier and Pedersen 2009). As discussed in more detail in Section 2, by reducing uncertainty about fundamental value and adverse selection when trades occur, dividends have the potential to affect liquidity risk. Non-dividend-paying firms tend to be associated with higher uncertainty (Gordon 1963; Fuller and Goldstein 2011) and higher adverse selection compared to dividend-paying firms (Lucas and McDonald 1998; Igan et al. 2006; Turki and Dereeper 2012). Dividends can serve as a mechanism to reduce information asymmetry between managers and shareholders, leading to a low degree of adverse selection (Howe and Lin 1992; Hussainey and Walker 2009; Hail et al. 2014). Many studies, including Pástor and Stambaugh (2003), Vayanos (2004), and Brunnermeier and Pedersen (2009), show that liquidity can shrink because of a ‘‘flight to quality’’,[41] where liquidity providers fly from assets with a high degree of uncertainty regarding fundamental value to assets with lower uncertainty. Due to the fact that dividends provide information about, for example, future cash flows, they reduce uncertainty about fundamental value as well as adverse selection, potentially reducing

[41] According to Brunnermeier and Pedersen (2009), flight to quality refers to a sharp increase in the market’s risk aversion during periods of turmoil.

the sensitivity of stock to market shocks. During large market downturns, liquidity tends to be mostly low because capital is limited and overall uncertainty is high. As a result, non-paying stocks will be particularly sensitive to the effects of exogenous shocks to liquidity. Therefore, investors' demand for dividend-paying stocks, and thus the value of such stocks relative to non-paying stocks, is higher when market liquidity is low (Banerjee et al. 2007). Consequently, we expect dividend-paying stocks and stocks with high dividends to have lower return sensitivity to innovations in market liquidity.

Our empirical analysis is divided into two main parts. The first part focuses on the effect of dividend policy decisions on systematic liquidity risk. We use a liquidity factor (LIQ hereafter) and the market return (MKT hereafter) to produce the liquidity risk from a two-factor liquidity augmented model (LCAPM hereafter). To construct our LIQ, we follow Liu (2006). Specifically, LIQ represents a mimicking liquidity factor that is defined as the payoff from taking a long position in most liquid portfolio and short position in least liquid portfolio. Then, we perform univariate and multivariate analysis to estimate the impact of dividend policy decisions on systematic liquidity risk. Specifically, we investigate whether stocks of dividend payers and/or stocks of firms with high dividends exhibit greater or lower liquidity risk than comparable stocks of non-dividend payers and/or stocks of firms with low dividends.

Using a sample of UK firms for the period 2000-2013,[42] we find that non-dividend-paying firms exhibit significantly higher systematic liquidity risk than their dividend-paying counterparts. We also find that the systematic liquidity risk of dividend payers is significantly negatively associated with the amount of dividend payments. These findings remain robust after controlling for other determinants of liquidity risk.

We subject our findings to a battery of robustness checks. First, a major concern with our analysis is the likelihood that the relation between dividend

[42] The data obtained start from January 1996. Our analysis starts from 2000 because we use five-year monthly returns to calculate liquidity risk.

policy and systematic liquidity risk is endogenously determined. In other words, firms with lower systematic liquidity risk could be more likely to pay dividends. Another issue is that the relation could be an outcome of omitted variables. To address these concerns, we conduct a two-stage regression approach using an instrumental variable (IV) model and Heckman-type model. Our main results are robust to these model specifications as we document a significant difference between dividend payers and non-payers and between payers of high dividends and payers of low dividends. We also account for endogeneity resulting from omitted or unobserved factors by applying a fixed-effects model. Our results continue to show a significantly lower liquidity risk for dividend payers than for non-payers as well as a lower liquidity risk for payers of high dividends than for payers of low dividends.

Second, we examine the impact of the dividend policy decisions on the systematic liquidity risk for sub-samples of firms with different characteristics that proxies for the amount of information, namely firm size and growth opportunities. The amount of information available can influence the trading decisions of investors since they affect the level of uncertainty and adverse selection they face (Ng 2011) and thereby affect systematic liquidity risk. When liquidity declines, investors are less likely to demand stocks that are associated with higher asymmetric information (Ng 2011). Small, low-growth firms are associated with lower levels of information and hence uncertainty and adverse selection will be more severe in these firms, as compared to large, low-growth firms. Therefore, investors are more likely to sell off the stocks of these firms during low market liquidity. Hence, we should expect the effect of dividend policy on liquidity risk to be stronger in these firms. We find that compared to non-dividend-paying stocks, dividend-paying stocks have a significantly lower systematic liquidity risk, especially when they are small and have more growth opportunities.

Finally, we estimate our main models using liquidity risk that is measured using alternative proxies for liquidity. Liquidity is a multifaceted concept and can be viewed from different aspects of trading behaviour. Stoll (2000) also points out that there is no consensus on the best liquidity proxy, and each liquidity proxy captures a particular element of liquidity and trading behaviour. The findings show that liquidity risk is significantly associated with dividend policy when other liquidity measures, such as bid–ask spread and turnover ratio, are used to measure liquidity risk. However, the magnitude of the effect varies with different measures. Furthermore, similar results are reported when we use liquidity risk that is estimated using alternative models rather than LCAPM such as the Fama-French three-factor and the four-factor models. Dividend payers and payers of high dividends continue to exhibit lower liquidity risk compared to non-payers and payers of low dividends.

Overall, this study suggests that systematic liquidity risk is significantly associated with dividend policy decisions. These findings are consistent with the predictions of the asymmetric information theory of Bhattacharya (1979) and Miller and Rock (1985), which suggests that dividend payments are associated with lower asymmetric information and hence higher liquidity. Our result is also in line with the arguments of Amihud and Mendelson (1986), Pástor and Stambaugh (2003), and Liu (2006), who suggest that since liquidity is priced, an increase in liquidity will lead to lower liquidity risk and, therefore, lower expected returns. Our findings are also consistent with the flight-to-quality phenomenon (Acharya and Pedersen 2005; Brunnermeier and Pedersen 2009) in which adverse liquidity shocks force investors to sell off assets that are associated with higher uncertainty, asymmetric information and trading costs, leading to a decline in asset prices. Banerjee et al. (2007) argue that during periods of low market liquidity, the demand of investors for dividend-paying stocks, and thus the value of such stocks relative to non-paying stocks, is higher.

This chapter makes at least two contributions. First, many studies show that systematic liquidity risk is related to different areas of corporate finance such as stock split (Lin et al. 2009), information quality (Ng 2011), seasoned equity offerings (Bilinski et al. 2012), ownership structure (Cao and Petrasek 2014) and index revisions (Mazouz et al. 2014). We contribute to this growing literature by investigating the impact of dividend decisions on systematic liquidity risk. Second, we contribute to the literature on the valuation effects of dividend policy (Al-Yahyaee et al. 2011; Bozos et al. 2011; Dasilas and Leventis 2011; Liu and Chen 2015). Recent literature in finance suggests that liquidity risk is a non-diversifiable systematic risk that affects stock returns. Many studies find that expected stock returns are positively related to the sensitivities of returns to fluctuations in aggregate liquidity (Pástor and Stambaugh 2003; Acharya and Pedersen 2005; Liu 2006) Liquidity risk is also significant and priced in different markets, suggesting that it is a persistent risk that affects firm value (Lee 2011).To the best of our knowledge, we are the first to introduce systematic liquidity risk as an important factor by which dividend policy can affect firm value.

Our study is related to the work of Banerjee et al. (2007), who show that systematic liquidity risk declines following dividend initiations. Our study, however, differs from the research by Banerjee et al. (2007) in at least two ways. First, their empirical analysis focuses only on dividend initiations, and in particular, on the effect of the decision as to whether the firm pay a dividend (and not how much to pay). Thus, while the findings of Banerjee et al. (2007) might explain the effects of dividend initiation on systematic liquidity risk, they cannot explain the effect of dividend levels. This is a substantial shortcoming because the empirical research on dividend decisions suggests that firm managers are more likely to face decisions related to the level of dividends than decisions to either introduce dividends for the first time or eliminate existing dividends (Li and Lie 2006). The second difference between this study and that of Banerjee et al. (2007) concerns the empirical results. Their results are based on univariate analysis.[43] We posit that, like any other financial factor, the systematic liquidity risk will not have a uniform effect across all firms. Rather, the firm's return sensitivity to market liquidity might depend on other factors such as firm-specific variables. Thus, a univariate analysis may not reveal the true effect of dividend policy on systematic liquidity risk. A multivariate analysis is necessary to understand whether, and why, individual firms with different characteristics display varying sensitivity to market liquidity.

[43] They create two value-weighted portfolios. The first portfolio includes firms in the three years prior to dividend initiation and the second portfolio consists of the same firms but after dividend initiation. Then, they estimate the liquidity risk of each portfolio using the market model, the three-factor model and the four-factor model while including liquidity factor. Then, they use a univariate analysis to compare the liquidity beta of pre-dividend portfolio to that of post-dividend portfolio.

The rest of this chapter is organized as follows. We review the literature in Section 4.2 and state the hypotheses to be tested in Section 4.3. We describe our methodology and data in Section 4.4. We present the empirical findings in Section 4.5 and conclude the chapter in Section 4.6.

4.2. Related literature

4.2.1. Liquidity risk and assets pricing

The existing research on asset pricing assumes that illiquid securities have higher liquidity risk compared to liquid securities. Therefore, the CEC increases due to the higher demand of investors for a higher liquidity premium. Prior literature on asset pricing has focused on the CAPM of Sharpe (1964) and Lintner (1965). According to this model, the systematic risk of a firm can be measured solely by the market beta (the sensitivity of a firm's stock return to the returns of total market), and there is a positive relationship between a security's expected return, its systematic risk and the expected market premium.

The CAPM model has received considerable empirical support. However, it was then challenged due to incompleteness by a number of papers including Amihud and Mendelson (1986), Fama and French (1993), Carhart (1997), Chordia et al. (2000), Amihud (2002), Pástor and Stambaugh (2003), Acharya and Pedersen (2005), and Liu (2006). Fama and French (1993) show that the systematic risk cannot be completely measured by market beta and therefore it should be accompanied by its sensitivity to other factors such as market capitalization and book-to-market ratio of firms. They argue that these non-market risk factors are priced and propose a three-factor model that incorporates, in addition to the market factor, a size factor (SMB), which represents the difference between the returns on the small and big size portfolios, and a value factor (HML), which represents the difference between the returns on the high and low book-to-market-ratio portfolios. Carhart (1997) further includes another risk factor, which is the momentum factor constructed by the difference between the returns on the high and low prior return portfolios.

Amihud and Mendelson (1986) are the first to examine the role of liquidity in asset pricing using the bid–ask spread as a measure for liquidity. They propose a model in which rational investors ask for high expected return for stocks with large bid–ask spreads. By analysing portfolios of NYSE stocks over the period 1961-1980, Amihud and Mendelson (1986) find empirical evidence for their model. They show a positive relationship between expected return and illiquidity. They explain this relationship on the basis that investors would expect to sell their shares at some point in the future, and that by doing so, they will be subject to transactions costs. If these transactions costs are high, rational investors would claim a high discount rate to the underlying stock. This view is confirmed by various empirical studies, which show that large bid–ask spread, large price impact, and low turnover ratio are associated with higher expected returns (Brennan and Subrahmanyam 1996; Brennan et al. 1998; Amihud 2002). Recently, international evidence further shows that illiquidity premium also presents in international markets (Lam and Tam 2011; Chai et al. 2013; Amihud et al. 2015).

Chordia et al. (2000), Hasbrouck and Seppi (2001), and Huberman and Halka (2001) propose a new area for investigating the relationship between liquidity and market return. They show that individual stock liquidity co-moves with market-wide liquidity. This co-movement between individual stock liquidity and market-wide liquidity is known as “commonality in liquidity” or “liquidity risk”. Using 30 stocks from the Dow Jones Industrial Average(DJIA), Hasbrouck and Seppi (2001) examine common factors in prices, order flows and liquidity. They find an association between common factors and both returns and order flows and that approximately two-thirds of the commonality in returns is explained by the common factors in the order flow. However, their results suggest less support for the existence of significant commonality in liquidity. Chordia et al. (2000), however, provide a conflicting result after examining the sources of commonality in the changes of different daily liquidity measures using 1169 US stocks. They argue that individual stock liquidity measured commove with market-wide liquidity. Using a market model for liquidity, they find a negative relationship between stock’s bid–ask spread and the aggregate level of market liquidity. They explain this finding as an indication of a reduction in inventory risk due to greater market trading which is most likely driven by uninformed traders. The presence of commonality also results from the effect of information asymmetry which is induced by informed traders who attempt to hide their activities by splitting block trades into a small number of transactions. Using 240 US stocks, Huberman and Halka (2001) investigate the commonality in liquidity, using depth and bid–ask spread as liquidity measures, and provide similar results to Chordia et al. (2000).

The development of the commonality in liquidity notion has focused the attention of liquidity studies towards systematic liquidity risk. For example, the commonality in liquidity has motivated further research to investigate whether the aggregate market liquidity is an important factor in explaining stock returns. Pástor and Stambaugh (2003) are the first to provide direct evidence that stock returns co-vary significantly with aggregate market liquidity. They develop a measure of market-wide liquidity as the equally weighted average of the liquidity measures of individual stocks on the NYSE and AMEX, using daily data within the month. They show that stocks whose returns are more sensitive to market liquidity require a higher rate of return than stocks whose returns are less sensitive to market liquidity factor. This result suggests that a stock's liquidity risk measured by beta, which is the return sensitivity to the aggregate liquidity, plays an important role in asset pricing. In particular, stocks with higher liquidity betas have higher expected returns.

The work of Pástor and Stambaugh (2003) was followed by several studies that examine the same issue. For example, Acharya and Pedersen (2005) examine how asset prices are influenced by liquidity risk. They present a liquidity adjusted capital asset pricing model and show that a stock's required rate of return depends on its expected liquidity and on the covariances of its own return and liquidity with the market return and liquidity. The model also shows that a negative shock to a security's liquidity results in low simultaneous returns and high predicted future returns. Liu (2006) develops a two-factor model that incorporates both a market factor and a liquidity factor (LCAPM) and shows that liquidity is a significant source of priced risk. He argues that the two-factor model performs better than the three-factor model of (Fama and French 1993). LCAPM considers the liquidity premium that both CAPM and the Fama and French three-factor model fail to capture. Moreover, liquidity risk can capture distress risk more directly than the size and the book-to-market factors.

Systematic liquidity risk has also been documented to be priced in markets other than the USA. Using the liquidity risk proxy suggested by Pástor and Stambaugh (2003), Martınez et al. (2005) investigate whether aggregate market liquidity is priced in the Spanish stock market. They show that systematic liquidity risk is priced only when the Amihud (2002) illiquidity ratio is used as a measure for liquidity. Luo and Jing (2011) examine the same issue in the Chinese stock market and find that the aggregate market liquidity risk is priced. Lam and Tam (2011) use nine measures of liquidity to examine the relationship between return and liquidity in the Hong Kong stock market. They find that liquidity is an important factor in explaining returns in Hong Kong. Moreover, using a sample of Japanese stocks, Li et al. (2014) examine whether liquidity is priced during the period 1975-2006 and find that liquidity is priced in the Japanese stock market. Ho and Chang (2015) examine whether liquidity is a source of priced systematic risk in stock returns of the Shanghai stock market. They find that the cross-sectional expected stock returns are related to the sensitivities of returns to fluctuations in aggregate market liquidity.

4.2.2. Systematic liquidity risk and dividend policy

The CAPM assumes a perfect world in which there are no transactions costs; therefore, investors can diversify without incurring costs. In such a perfect world, the only risk that is needed to fully explain cross-sectional differences in stock returns is the market beta. Recent research in finance argues that in practice, the costless trading assumption does not hold, and suggests that, in addition to market risk, investors are also concerned with the liquidity risk of their portfolio (Pástor and Stambaugh 2003; Sadka 2006; Ng 2011).[44]

Given its importance, the systematic liquidity risk has captured the attention of several finance researchers. For example, many studies examine the impact of several market events on systematic liquidity risk, including Lin et al. (2009) in the context of stock split, Lin and Wu (2013) in the context of seasoned equity offerings (SEOs) and Mazouz et al. (2014) in the context of index revisions. Other studies link systematic liquidity risk to some firm characteristics such as information quality (Ng 2011) and ownership structure (Cao and Petrasek 2014). We extend this literature by linking systematic liquidity risk to dividend policy. In this study, we argue that both the decision to pay dividends and the amount of dividend payment affect liquidity risk. Our argument proceeds as follows.[45] Systematic risk represents a covariation effect which indicates that a stock with higher systematic risk will perform relatively better during good economic conditions, but relatively worse during bad economic conditions. In the case of liquidity risk, the related economic condition is market liquidity.[46] Any reduction in market liquidity generally indicates an economic status in which there is outflow of investor and market maker from the equity markets; this outflow refers to as a flight to safety/quality (e.g., Pástor and Stambaugh 2003; Acharya and Pedersen 2005; Brunnermeier and Pedersen 2009). At times of market liquidity decline, different stocks will exhibit different degrees of investor and market maker outflow.

In 2000, Standard & Poor’s predicted a mended interest in dividends, declaring that “market weakness may boost interest in dividends as investors begin to see the value of a ‘bird in the hand’”.[47] This statement indicates that investors’ preferences for dividend-paying stocks relative to non-dividend-paying stocks differ over time conditional on the state of the market (Fuller

[44] The difficulty of trading financial securities during the financial crisis (2007-2008) suggests further indication of the importance of liquidity risk.
[45] See Ng (2011) for similar insights into the effect of information quality on liquidity risk.
[46] Market liquidity can be defined as the ability to trade large quantities quickly, at low cost, and without moving the stock price (Kyle 1985; Pástor and Stambaugh 2003; Liu 2006; Feng et al. 2016).
[47] See Fuller and Goldstein (2011).

and Goldstein 2011). According to Fuller and Goldstein (2011), there are several reasons why investors might condition their preference for dividend-paying stocks on the state of the market. For example, Kahneman and Tversky (1979) propose a theory which implies that people respond differently to certain versus probabilistic gains/losses and care more about losses than gains. Therefore, prospect theory indicates that investors may prefer the cash from dividend-paying stocks more when they expect future uncertainty or economic downturns, and less when the market is doing well. Dividend-paying stocks provide a return where at least part of the return is a certain gain over those non-dividend-paying stocks for which the gain/loss is uncertain. During periods of good macroeconomic conditions, while investors still value the more certain gain, they may value it less as the preference for loss avoidance is reduced. However, during economic downturn, investors prefer dividends as a cushion to their returns, especially if they are downside risk-averse. Such responses are based on the "flight to quality" phenomenon that is observed during market declines (Connolly et al. 2005; Brunnermeier and Pedersen 2009). To the extent that investors value dividends as a certain return, they may move from risky to less risky investments, in this case from non-dividend and/or low-dividend-paying stocks to dividend and/or high-dividend-paying stocks.

Another possibility relates to the dividends' ability to convey information. Existing literature suggests that dividend-paying firms are better able to signal managers' expectations than non-dividend-paying firms[48] and this signalling ability may be more valuable during bad times than during good times. During times of bad economic conditions, dividend-paying firms can provide a positive signal by just keeping dividend payments; in such times the commitment to pay dividends tends to be more valuable, hence increasing the value and significance of the signal. However, during times of good economic conditions, it is likely that firms will perform well and the chance of, and costs associated with, financial distress are lower. Therefore,

[48] Dividends can either signal managers' expectations regarding future earnings (e.g., Bhattacharya 1979; John and Williams 1985; Miller and Rock 1985) or signal that managers will not waste excess cash (e.g., Easterbrook 1984; Jensen 1986; Lang and Litzenberger 1989).

the commitment to pay is less likely to be valuable, and thus the value of dividend signal is likely to be lower. It is argued, therefore, that a decision to pay dividends during good economic conditions conveys less information than a decision to pay dividends in market downturns.

Based on the above discussion, we can argue that during periods of low aggregate liquidity, the outflow of investor and market maker tends to be more significant for non-dividend-paying stocks and/or stocks with lower dividend payment. This is due to a decrease in the demand of investors for stocks associated with higher adverse selection and uncertainty. Furthermore, market makers are less likely to provide liquidity to such stocks because of concerns about adverse selection which, in turn, might further reduce investors' demand for these stocks. Therefore, the performance of these stocks is worse when market liquidity declines. On the other hand, at times of market liquidity increases, there is an inflow of investors and market makers, which leads to an increase the demand and liquidity of stocks associated with higher uncertainty and adverse selection. It is worth mentioning that the earlier arguments entail that the demand for dividend-paying stocks and/or stocks with higher dividend payment is less likely to be affected by fluctuations in market liquidity. As a result, the returns of stocks with low or no dividends are expected to be more sensitive to changes in market liquidity. That is, dividend payment can affect liquidity risk.

Furthermore, low levels of liquidity would make it difficult for investors to execute their trades, and they would require a higher risk premium to compensate them for this higher liquidity risk. However, stocks that pay cash dividends help investors to meet their liquidity needs with little or no trading and thus enable them to avoid trading costs. As a result, investors may have a preference for dividend-paying stocks and stocks that pay high dividends.[49] Thus, it is suggested that a firm that pays dividends would be less likely to be affected by lower liquidity during market downturns and would have a lower liquidity risk compared to a firm that does not pay dividends. Simply put,

[49] Dong et al. (2005) present survey evidence that retail investors prefer dividends, partly because their costs of cashing in dividends are lower than the transaction costs associated with selling shares.

investors will require a smaller risk premium as compensation for having such stocks in their portfolio.

Recently, Banerjee et al. (2007) studied the changes in systematic liquidity risk following dividend initiations where dividend initiation is defined as the first cash dividend payment. They use a large sample of US dividend-initiating firms over the period 1966-1999 and construct two portfolios. One consists of non-paying firms in the last three years prior to dividend initiation and the second one consists of the same firms but after dividend initiation. By estimating the market model, the three-factor model and the four-factor model for each portfolio while considering the market-wide liquidity factor, they find that the sensitivity of stock returns to aggregate liquidity declines after dividend initiations.

4.3. Hypothesis development

In this study, we argue that dividend policy can influence systematic liquidity risk for several reasons. First, given that dividend payment affects stock liquidity (Howe and Lin 1992; Gurgul et al. 2003; Bozos et al. 2011), it is also expected to affect the liquidity risk premium. Barry and Brown (1985) claim that investors require a positive premium for illiquid stocks because of the higher uncertainty resulting from lack of information. Thereby securities with small amount of available information are found to have higher systematic risk. This argument is in line with Arbel and Strebel (1982) who find that any improvement in the information environment would reduce the adverse information costs. Amihud and Mendelson (1986) and Amihud (2002) show that expected returns are a decreasing function of liquidity as investors require compensation for incurring higher transaction costs because of holding less liquid markets. Several papers including Bekaert et al. (2007), Lam and Tam (2011), Chai et al. (2013), and Amihud et al. (2015) provide empirical evidence consistent with Amihud and Mendelson (1986) that liquidity is a determinant of expected returns. Chordia et al. (2000), Hasbrouck and Seppi (2001), and Huberman and Halka (2001) have opened a new research area on the effect of liquidity on the cross section of stock returns. They suggest that liquidity risk represents a source of non-diversifiable risk which should be reflected in an asset's expected returns (e.g., Pástor and Stambaugh 2003; Korajczyk and Sadka 2008; Li et al. 2014; Ho and Chang 2015). Second, dividend payment reduces uncertainty and adverse selection, and thereby could reduce liquidity risk by reducing the sensitivity of a firm's share price to the non-diversifiable component of risk. For example, in times of a drop in market liquidity, there is generally selling pressure on equities (Pástor and Stambaugh 2003; Ng 2011). Stocks with no or low dividends could experience more negative returns if buyers offer lower prices to sellers of these stocks because of the higher uncertainty and/or greater probability of adverse selection associated with a high level of asymmetric information. Furthermore, the relative returns of non-dividend- and low-dividend-paying stocks could be even more negative because: i) investors are likely to be more risk averse during periods of low market liquidity, and commonality in trading decisions generates pressure on stock prices (Pástor and Stambaugh 2003) and ii) investors who sell some stocks from their portfolios usually choose to mitigate risk by selling stocks with more uncertainty since investors perceive non-dividend (low-dividend) paying stocks as being riskier (see, e.g., Grullon et al. 2002; Hoberg and Prabhala 2009; Fuller and Goldstein 2011; Eije et al. 2014).

Furthermore, when the aggregate market liquidity is low, the liquidation cost of stocks becomes higher. As a result, investors are more likely to invest in dividend-paying firms and firms that pay high dividends because dividend payments help them avoid the high trading costs (Banerjee et al. 2007; Kuo et al. 2013). Pástor and Stambaugh (2003) suggest that when the aggregate liquidity is low, assets with high sensitivity of returns to aggregate liquidity lead to a reduction in the wealth of investor. Therefore, it is expected that the sensitivity of stocks returns to aggregate liquidity is lower in dividend-paying firms and firms that pay a high amount of dividends. This leads to the following testable hypotheses:

H3: dividend-paying stocks have lower liquidity risk than non-dividend-paying stocks.

H4: high-dividend-paying stocks have lower liquidity risk than low-dividend-paying stocks.

4.4. Methodology and data

4.4.1. Empirical models

First of all, we estimate the systematic liquidity risk using the following CAPM model augmented by a liquidity factor (LCAPM).[50] More specifically, in each year, the liquidity beta is estimated from a regression of monthly stock returns on market risk factor and liquidity risk factor as follows:[51]

$$r_{it} - r_{ft} = \propto_i + \beta_{mi}(r_{mt} - r_{ft}) + \square_{iliqi}\, LIQ_t + \varepsilon_{it} \qquad (4.1)$$

where r_{it} is the return on stock *i* in month *t* and r_{ft} is the return on the three-month UK T-Bills in month *t*; r_{mt} is the return on the FTSE All SHARES in month *t*; β_{mi} is the market risk "beta" for stock *i*, while β_{iliqi} is the systematic liquidity risk "beta" for stock *i*. LIQ_t is the stock liquidity factor. Similar to Liu (2006), we construct a mimicking liquidity factors as follows: at the beginning of each month from January and July 1996 to July 2013, all FTSE ALL SHARES ordinary common stocks are sorted in ascending order based on their liquidity measures to form two portfolios. The first contains the 35% of stocks with the lowest liquidity measure and the second includes the 35% of the stocks with the highest liquidity measure.[52] These portfolios are held for six months after the portfolio formation period.[53] Then, the mimicking liquidity factor *LIQ* are constructed as the difference in the monthly returns between the two portfolios.

[50] Section 4.5.4 reports robustness tests using other liquidity risk model specifications.
[51] We estimate liquidity risk (β_{iliqi}) using firm monthly returns over the previous five years with a minimum of 36 available returns. We use monthly returns since short horizon returns are affected more by noise due to non-synchronicity trading and bid–ask spread.
[52] Many studies follow the same approach to construct the mimicking liquidity factor (see e.g., Liu 2006; Bilinski et al. 2012; Mazouz et al. 2014).
[53] As stated by Liu (2006), the six-month holding period is selected because it gives a moderate liquidity premium compared to the one- and 12-month holding period, which seems plausible for estimating the liquidity factor.

Mimicking portfolios have been used in several studies of economic factors. Breeden (1979) argues that mimicking portfolios can replace the state variables in the Merton (1973) model. For example, Chen et al. (1986) and Breeden et al. (1989) employ these portfolios for several macroeconomic factors, whereas Fama and French (1993) use mimicking portfolios to capture book-to-market and size effects. Balduzzi and Robotti (2010) compare linear factor models using non-traded factors and mimicking portfolios. They find that mimicking portfolios allow the characteristics-based explanation of the cross section of stock returns to be turned into a risk-based explanation and conclude that estimating linear models with mimicking portfolios is favoured.

In order to estimate the liquidity risk factor as the difference in returns between illiquid and liquid stocks, the stocks have to be sorted according to their liquidity. We measure stock liquidity using Amihud’s illiquidity ratio. Amihud (2002) proposes measuring illiquidity for a given stock on a given day as the ratio of absolute percentage price change per dollar of daily trading volume. This is comparable to Kyle’s lambda as given by the response of price to order flow. Hasbrouck (2009) finds that among the liquidity measures constructed from daily data, Amihud’s illiquidity ratio is the best one among the high-frequency dynamic price impact measures of liquidity. Likewise, by comparing several measures of liquidity, Goyenko et al. (2009) conclude that Amihud’s illiquidity ratio produces significant results in capturing the price impact of trade. They find that it is comparable to intraday estimates of price impact such as Kyle’s lambda. Therefore, we use Amihud’s illiquidity ratio as the main liquidity proxy in our study.

While the study mainly uses Amihud’s illiquidity ratio, an obvious question is whether the main results hold using other measures of liquidity. It is well recognized that liquidity can be measured in various ways and that some measures could produce somewhat different results because they could capture different aspects of liquidity (see, e.g., Korajczyk and Sadka 2008). Therefore, as a robustness check, we use two additional measures of liquidity: proportional bid–ask spread and turnover ratio to reflect trading costs and trading activity aspects of liquidity, respectively.

Second, we regress liquidity betas on dividend variables while controlling for several control variables:

$$\beta_{iliqi,t} = \gamma_0 + \gamma_1 Dividend\,policy_{i,t-1} + \gamma_2 Controls_{i,t-1} + (YearDummies) + (IndustryDummies) + u_{it} \qquad (4.2)$$

where $\beta_{iliqi,t}$ is the liquidity beta for stock i in year t and $Dividend\,policy_{i,t-1}$ is a dummy variable that relates to a firm's dividend policy. We define $Dividend\,policy_{i,t-1}$ in two ways: (i) as a dummy variable that equals 1 if a dividend payer and zero otherwise ($DIV_{i,t-1}$); and (ii) as a dummy variable that equals 1 if the stock is a high-dividend payer and zero otherwise ($HighDPS_{i,t-1}$). $Controls_{i,t-1}$ is a vector of control variables which may be correlated with liquidity risk. Consistent with the literature, the control variables include several characteristics such as stock liquidity, stock return, volatility[54] and firm size. A stock liquidity beta has been found to be related to stock liquidity (Pástor and Stambaugh 2003; Acharya and Pedersen 2005), and therefore we control for the level of stock liquidity. Stocks with different size could have different liquidity beta (Pástor and Stambaugh 2003). We use the market capitalization as a proxy for firm's size. We also control for other firm characteristics which prior research has documented that liquidity risk is likely to be associated with. For example, there are arguments and evidence that liquidity risk varies with growth opportunities, profitability and leverage (Ng 2011; Cao and Petrasek 2014).[55] All of the independent variables are lagged by one year to make sure that the information is available for investors to assess the stock before the covariation between stock return and changes in market liquidity takes place.[56] All variables are standardized

[54] According to Pástor and Stambaugh (2003) and Ng (2011), the inclusion of returns and the volatility of returns allow some role for short-run return dynamics.
[55] To estimate the determinants of liquidity beta, Pástor and Stambaugh (2003) include several characteristics. They note on p.664 "the list of characteristics is necessarily arbitrary". This arbitrariness arises because liquidity risk is a relatively new concept and prior literature provides limited guidance on its determinants.
[56] Furthermore, the use of explanatory variables that are lagged by one year can partially account for the potential endogeneity problem, consistent with the econometric point of view of previous studies including e.g., Ng (2011) and Cao and Petrasek (2014).

to have zero mean and unit variance in each year.[57] Year and industry dummy variables are included to control for time and industry fixed effects.

4.4.2. Sample description

Our sample is based on the annual constituent of the FTSE ALL share index in DataStream over the period 1996-2013. Both stocks that survived the entire study period and those delisted anytime during the study period are included. Several filters are imposed to obtain the final sample. First, as a common practice, financial and utilities firms are excluded, resulting in a sample of 1,169 non-financial and non-utilities firms over the period 1996-2013.[58] Next, we remove observations with missing variables of dividend per share. Finally and following Cao and Petrasek (2014), all variables are winsorized at the 1st and 99th tails to alleviate the impact of outliers.[59] This results in a final sample of 7,280 firm-year observations covering 870 different firms.

The estimation of liquidity risk using (LCAPM) model requires the monthly returns on UK Treasury bills (the risk-free rate) and the return on the FTSE ALL SHARE index. Moreover, it requires the closing price, the ask price, the bid price, the quantity trading volume, and the number of outstanding shares for each firm. All of these data and the data on other variables are obtained from DataStream.

[57] Standardized coefficients enable us to compare the relative effects of two or more explanatory variables that have different units of measurement. We interpret the effects of a standardized variable as the standard deviation changes in Y results from an increase in one standard deviation in X (Sekaran and Bougie 2010).

[58] The data obtained start from January 1996. Our analysis starts from 2000 because we use five-year monthly returns to calculate liquidity risk. The selection criteria and distribution of the sample across time and industries are presented in Table 3.1.

[59] Winsorization is a statistical procedure help in reducing the impact of outliers in the sample. This procedure can be conducted in two ways: trimming the sample, which involves deleting a certain percentage of values in one or both sides of the distribution, or redefining the most extreme values in the tail(s) of the distribution to the closest extreme values (Yale and Forsythe 1976).

Table 4.1 Summary statistics

This table reports summary statistics of the variables under consideration for the full sample. At each December between 2000 and 2013, the liquidity beta for each stock is computed. The liquidity beta is estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). Liquidity is measured by the Amihud illiquidity ratio (Amihud), bid–ask spread (Spread) and turnover ratio (Turnover). DPS is the amount of dividend paid per share. DIV is a dummy variable that takes the value of 1 for dividend payers, and 0 otherwise. Leverage is the sum of current liabilities and long-term debt over total book assets. The return is the average of daily stock returns. The volatility is the standard deviations of daily returns. Book-to-market ratio is defined as the book value of total shareholder equity divided by the market value of equity. Profitability is the ratio of earnings before interest and taxes to total assets. Firm size is the market capitalization in millions of Pounds.

	Observations	Mean	SD	Median	Min	Max
Liquidity beta (Amihud)	7280	0.677	0.933	0.495	-1.032	3.853
Liquidity beta (Spread)	7280	0.706	0.961	0.483	-0.955	3.890
Liquidity beta (Turnover)	7280	0.763	0.869	0.483	0.000	4.493
Amihud	7090	0.002	0.007	0.000	0.000	0.048
Spread	7188	0.029	0.033	0.020	0.001	0.178
Turnover	7049	0.004	0.003	0.003	0.000	0.018
DPS	7280	0.095	0.151	0.046	0.000	0.949
DIV	7280	0.737	0.440	1.000	0.000	1.000
Leverage	7250	0.198	0.176	0.173	0.000	0.802
Return (%)	7060	-0.010%	0.210%	0.000%	-0.870%	0.440%
Volatility (%)	6888	1.980%	1.770%	1.810%	0.000%	9.110%
Book-to-market	7156	0.660	0.664	0.503	-1.111	3.704
Profitability	7193	0.045	0.170	0.073	-0.867	0.352
Firm size (£ millions)	5729	2.443	9.388	0.208	0.004	72.400

Table 4.1 reports the summary statistics for the dependent and independent variables of the full sample.[60] The dependent variable is the liquidity risk estimated from the LCAPM model using Amihud's illiquidity ratio as a main liquidity measure. The systematic liquidity risk has a positive mean of 0.677. Moreover, using bid–ask spread and turnover ratio as alternative liquidity measures, the liquidity beta has a mean of 0.706 and 0.763, respectively. The average illiquidity ratio is 0.002, suggesting that, on average, stock price moves by 0.2% for each one dollar of trading volume. The average of the stock turnover ratio is 0.004 and the mean proportional bid–ask spread is 2.9%, which is higher than the 1.1% reported by Agarwal (2007) in the US

[60] Appendix C.2 reports the summary statistics of the sample of dividend-paying stocks.

market. Approximately 74% of firm-years have dividend payments with an average dividend per share of £0.095. The standard deviation of daily returns is 1.98%, which is lower than that of the US firm. For example, Ng (2011) and Cao and Petrasek (2014) find an average standard deviation of 2.3% and 3.9%, respectively. The average daily return is -0.013%. The average (median) size of sample firms is £2.443 million (£0.208 million). UK firms are moderately levered since the mean of leverage (debt-to-asset ratio) is 19.8%, and this is equivalent to the average of 20% reported by Cao and Petrasek (2014) in the case of the US firms. The book-to-market ratio is 0.66, which is somehow comparable to that of US firms. For example, Ng (2011) find an average book-to-market value of 0.54 and Cao and Petrasek (2014) find an average of 0.52. As for profitability, an average firm would have 4.5% earnings before interest and taxes to total assets.

Table 4.2 presents the Pearson pairwise correlation matrix between the variables used in this study. The correlation coefficients between main variables, *DIV*, *DPS* and the different measures of liquidity betas are largely consistent with expectations. The correlation coefficients between *DIV*, *DPS* and all liquidity beta measures are negative. Furthermore, multicollinearity does not appear to be a problem, as all correlation coefficients are low with a maximum value of 0.464. To confirm this, we use the variance inflation factor. With all the key variables included in the model, none of the VIF values exceed the rule of thumb of 10 (with a maximum of 2.03), implying that multicollinearity is not a serious concern in our model.

Table 4.2 Correlation matrix

This table reports the correlations for dividend variables and control variables. DPS is the amount of dividend paid per share. DIV is a dummy variable that takes the value of 1 for dividend payers, and 0 otherwise. Amihud is the Amihud illiquidity ratio. Turnover is the turnover ratio. Spread is the proportional bid–ask spread. Leverage is the sum of current liabilities and long-term debt over total book assets. The return is on the average of daily stock returns. The volatility is the standard deviations of daily returns. Book-to-market ratio is defined as the book value of total shareholder equity divided by the market value of equity. Profitability is the ratio of earnings before interest and taxes to total assets. Firm size is the market capitalization in millions of Pounds.

	Liquidity beta (Amihud)	Liquidity beta (Spread)	Liquidity beta (Turnover)
DIV	-0.1500***	-0.1767***	-0.1651***
DPS	-0.1504***	-0.1655***	-0.1090***

	DIV	DPS	Leverage	Amihud	Turnover	Spread	Profitability	Volatility	Return	Firm size	**VIF**
DIV											**1.50**
DPS	0.375***										**1.32**
Leverage	0.023*	0.085***									**1.05**
Amihud	-0.285***	-0.161***	-0.003								**1.56**
Turnover	-0.018	0.046***	0.163***	-0.176***							**1.16**
Spread	-0.411***	-0.298***	-0.051***	0.578***	-0.255***						**2.03**
Profitability	0.464***	0.252***	-0.005	-0.242***	-0.067***	-0.393***					**1.41**
Volatility	-0.144***	-0.067***	0.017	0.129***	0.036***	0.151***	-0.120***				**1.11**
Return	0.091***	0.058***	-0.063***	-0.119***	-0.039***	-0.140***	0.160***	-0.220***			**1.13**
Firm size	0.119***	0.348***	0.009	-0.073***	0.042***	-0.187***	0.103***	-0.055***	0.038***		**1.12**
Book-to-market	-0.126***	-0.156***	-0.102***	0.204***	-0.065***	0.244***	-0.170***	0.039***	-0.159***	-0.064***	**1.12**

4.5. Empirical results

In this section, we present the results of the impact of the firm's two dividend policy decisions (decision to pay dividends and amount of dividend paid) on its systematic liquidity risk. First, we report the univariate regarding the difference in systematic liquidity risk between dividend- and non-dividend-paying stocks as well as high- and low-dividend-paying stocks. Next, we present the multivariate regression results.

4.5.1. Univariate analysis

Panel A of Table 4.3 presents the results from our univariate analysis. Dividend payers have a mean systematic liquidity risk of 0.59 (median 0.44), which is lower than that of non-dividend payers (mean of 0.91 and median of 0.67). The difference in the systematic liquidity risk of the two groups is 0.32 (median of 0.23) and is significant, as confirmed by our statistical tests. This provides the first evidence to support our hypothesis (H3), which predicts that dividend payers have lower systematic liquidity risk than non-dividend payers.

Panel B of Table 4.3 shows that high-dividend payers have a mean systematic liquidity risk of 0.48 (median 0.32) and that low-dividend payers have a mean of 0.71 (median 0.58). The difference in the systematic liquidity risk of the two groups is 0.23 (median of 0.26), which is significant at 1% or better. This provides evidence to support our hypothesis (H4), which suggests that high-dividend payers have lower systematic liquidity risk than low-dividend payers.

Table 4.3 Univariate analysis

This table presents the univariate analysis of the systematic liquidity risk of dividend payers and non-dividend payers as well as high-dividend- and low-dividend-paying stocks using the t-test for differences in mean and the Wilcoxon-Mann-Whitney test for differences in median. At each December between 2000 and 2013, the liquidity beta for each stock is computed. The liquidity beta is estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). Liquidity is measured by Amihud's illiquidity ratio (Amihud).

Panel A: Dividend payers vs. Non-dividend payers				
Liquidity risk	Dividend payers	Non-dividend payers	Mean test	Median test
Mean	0.5931	0.9108	11.4003***	
Median	0.4394	0.6693		9.594***
Panel B: High-dividend payers vs. Low-dividend payers				
Liquidity risk	High-dividend payers	Low-dividend payers	Mean test	Median test
Mean	0.4725	0.7046	10.352***	
Median	0.3228	0.5842		9.900***

We also observe significant differences in other characteristics of dividend- and non-dividend-paying stocks, consistent with the literature.[61] For example, dividend-paying stocks are larger and more profitable than non-dividend-paying firms (see, e.g., Fama and French 2001; Banerjee et al. 2007; Kuo et al. 2013; Chang et al. 2016; Firth et al. 2016). Moreover, dividend payers have lower volatility in their returns compared to non-dividend payers, indicating that dividend-paying stocks tend to be less risky (Baskin 1989; Allen and Rachim 1996; Hussainey et al. 2011; Eije et al. 2014; Chang et al. 2016; Firth et al. 2016). Non-dividend payers have higher averages of both Amihud's illiquidity ratio and bid-ask spread, suggesting that non-dividend payers are less liquid than dividend payers (Howe and Lin 1992; Agarwal 2007).

Similar significant differences are also observed for high- and low-dividend-paying stocks. More specifically, stocks that pay a high amount of dividends tend to be larger and more profitable than their counterparts (Jabbouri 2016). Furthermore, payers of a high amount of dividends are less risky (Aivazian et al. 2003; Brav et al. 2005; Chang et al. 2016; Firth et al. 2016) and more liquid (Howe and Lin 1992) than low-dividends payers. Stocks that pay a high

[61] These results are reported in Appendix C.3.

amount of dividends tend to have a higher leverage ratio. This is in line with the view that higher leverage might simply be a proxy for older, larger, more stable, and more profitable companies that are better able to afford to pay dividends (Von Eije and Megginson 2008). The growth opportunities variable shows that high-dividend payers have a higher mean and median than low-dividend-paying firms. This is consistent with Aivazian et al. (2003), who show a positive relationship between dividends and growth opportunities using a sample of developing countries. They suggest that market-to-book value may be a sign of a high cash flow ratio resulting from the present value of current investment opportunities, and hence reflect the current performance of the firm.

4.5.2. Multivariate analysis

Table 4.4 reports the regression results for model (4.2), in which we regress liquidity betas on the decision to pay dividend variable (*DIV*) and other control variables. In the first two columns, we simply regress systematic liquidity risk on the *DIV* dummy without controlling for firm-specific characteristics. The results in Column (1) show that the coefficient on *DIV* is negative (-0.32) and highly significant (t-value = -9.84), suggesting that the systematic liquidity risk of dividend-paying firms is significantly lower than that of non-dividend-paying firms. In Column (2), we include year and industry effects to account for unobserved common time trends and industry-level heterogeneity. We find that the difference in the systematic liquidity risk between dividend- and non-dividend-paying firms decreases (-0.28), but remains statistically significant (t-value = -8.14). Column (3) includes the control variables, but not the industry and year dummies, while Column (4) includes control variables and accounts for both year and industry fixed effects. The results show that the relation between systematic liquidity risk and the dividend payment are not sensitive to the model specification. The coefficients on *DIV* are significantly negative in both Columns (3) and (4), implying that stocks that pay dividends have a lower systematic liquidity risk on average than those that do not pay. The difference in systematic liquidity risk of dividend- and non-dividend-paying firms varies between 0.18 and 0.12

and is both statistically and economically significant. The coefficient on *DIV* in Column (4) suggests that, on average, dividend-paying stocks have a liquidity risk that is 0.12 standard deviations lower than those of non-dividend-paying stocks.[62] These findings strongly support H3, which suggests that dividend payers have lower systematic liquidity risk than their nonpayer counterparts.

The results of the control variables are broadly consistent with the literature. The illiquidity ratio (Amihud) has a positive coefficient, indicating that illiquid stocks have higher systematic liquidity risk (see, e.g., Pástor and Stambaugh, 2003; Acharya and Pedersen, 2005; Cao and Petrasek, 2014). The effect of firm size on liquidity risk is negative and significant at the 1% level, which is consistent with findings of earlier studies (see, e.g., Pástor and Stambaugh 2003; Ng 2011). Further, liquidity betas are larger for stocks with lower profitability ratios and higher return volatility (Ng 2011). This finding is consistent with the flight-to-quality dynamics, which suggests that volatile stocks and stocks with low profitability are perceived by investors to be more risky. Therefore, they tend to be sold off to a greater extent compared to stocks with lower standard deviation of returns and higher profitability during periods of downturns. Finally, the coefficient on the book-to-market ratio is positive and significant, consistent with the view that a high book-to-market ratio reflects persistent distress and low liquidity (see, e.g., Ng 2011; Acharya et al. 2013).

[62] As indicated before, all variables except dummy variables are standardized.

Table 4.4 Difference in systematic liquidity risk between dividend payers and non-dividend payers

This table reports the regression results for model (2), which captures the difference in systematic liquidity risk of dividend payers and non-dividend payers. The dependent variable is systematic liquidity risk, estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). DIV is a dummy variable that takes the value of 1 for dividend payers, and 0 otherwise. Liquidity is measured by the Amihud illiquidity ratio (Amihud). Leverage is the sum of current liabilities and long-term debt over total book assets. The return is the average of daily stock returns. The volatility is the standard deviations of daily returns. Book-to-market ratio is defined as the book value of total shareholder equity divided by the market value of equity. Profitability is the ratio of earnings before interest and taxes to total assets. Firm size is the market capitalization in millions of Pounds. All variables are standardized to have zero mean and unit variance. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
DIV	-0.319***	-0.278***	-0.184***	-0.115***
	(-9.84)	(-8.14)	(-4.11)	(-2.57)
Leverage			0.024	0.054***
			(1.46)	(3.19)
Liquidity (Amihud)			0.015	0.032
			(0.70)	(1.15)
Profitability			-0.134***	-0.084***
			(-6.41)	(-3.96)
Volatility			0.177***	0.204***
			(8.98)	(9.93)
Return			-0.045***	-0.074***
			(-2.56)	(-3.79)
Firm size			-0.208***	-0.184***
			(-9.71)	(-9.54)
Book-to-market			0.009	0.056***
			(0.50)	(2.92)
Intercept	0.226***	0.248**	0.225***	0.169**
	(7.62)	(4.36)	(5.79)	(2.31)
Year effects	No	Yes	No	Yes
Industry effects	No	Yes	No	Yes
Observations	6410	6410	4632	4632
F-statistic	96.73***	21.26***	53.02***	27.99***
Adj. R-squared	0.0189	0.0665	0.1158	0.1636

Table 4.5 presents the results for models using *HighDPS* as a dummy variable for the amount of dividend paid. We stratify the sub-sample of dividend-paying firms into two groups according to their dividend per share (*DPS*). *HighDPS* takes a value of 1 for observations with above median *DPS* and 0 otherwise. Column (1) shows that the coefficient on *HighDPS* is negative and highly significant, implying that systematic liquidity is significantly negatively associated with amount of dividends. This finding remains robust to alternative model specifications (see Columns (2) to (4)). The coefficient on *HighDPS* ranges between -0.21 and -0.14, depending on the model specification. These figures are both statistically and economically significant. For example, the results in Column (4) suggest that, on average, the liquidity risk of stocks that pay high dividends is 0.14 standard deviations lower than those that pay low dividends. These findings strongly support H4, which posits that high-dividend-paying stocks have lower liquidity risk than their low-dividend-paying counterparts.

As for the control variables, the coefficient illiquidity ratio (Amihud) is positive and significant. This finding is consistent with earlier studies which document a negative association between liquidity level and liquidity risk (Pástor and Stambaugh 2003; Acharya and Pedersen 2005; Cao and Petrasek 2014). Moreover, liquidity betas are higher for stocks with higher volatility and smaller market capitalization (Ng 2011; Cao and Petrasek 2014), and higher book-to-market ratios (Ng 2011; Acharya et al. 2013).

We further investigate the effect of the amount of dividend payment on liquidity risk by regressing liquidity beta on a continuous dividend variable measured by the dividend per share (*DPS*). Table 4.6 shows that the coefficient on *DPS* is significantly negative, regardless of the model specification. In terms of economic significance, the results in Column (4) suggest that a one standard deviation increases in dividend per share results in 0.07 standard deviations decrease in the liquidity risk. These findings are again consistent with the predictions of H4.

Table 4.5 Difference in systematic liquidity risk between high-dividend payers and low-dividend payers

This table reports the difference in liquidity risk of high-dividend payers and low-dividend payers. The dependent variable is systematic liquidity risk, estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). HighDPS is a dummy variable that takes the value of 1 for stocks with DPS higher than median, and 0 otherwise. DPS is the amount of dividends paid per share. All other variables are defined in the notes to Table 4.4. All variables are standardized to have zero mean and unit variance. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
HighDPS	-0.280***	-0.213***	-0.212***	-0.144***
	(-10.35)	(-7.85)	(-5.85)	(-3.96)
Leverage			-0.014	0.016
			(-0.76)	(0.83)
Liquidity (Amihud)			0.109***	0.147***
			(5.06)	(6.66)
Profitability			-0.047**	-0.012
			(-2.26)	(-0.58)
Volatility			0.192***	0.228***
			(8.44)	(9.69)
Return			-0.040*	-0.072***
			(-1.94)	(-3.12)
Firm size			-0.249***	-0.226***
			(-12.26)	(-11.48)
Book-to-market			0.030	0.068***
			(1.48)	(3.31)
Intercept	0.139***	0.183***	0.168***	0.254***
	(6.90)	(2.88)	(6.45)	(3.10)
Year effects	No	Yes	No	Yes
Industry effects	No	Yes	No	Yes
Observations	5364	5364	3379	3379
F-statistic	107.15***	17.38***	55.82***	26.3***
Adj. R-squared	0.0194	0.0561	0.1279	0.1719

Table 4.6 The impact of the dividend per share on liquidity risk

This table reports the impact of dividend per share on liquidity risk. The dependent variable is systematic liquidity risk, estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). DPS is a continuous variable that represents the amount of dividend paid per share. All other variables are defined in the notes to Table 4.4. All variables are standardized to have zero mean and unit variance. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
DPS	-0.130***	-0.099***	-0.098***	-0.072***
	(-9.21)	(-7.41)	(-5.70)	(-4.28)
Leverage			-0.011	0.02
			(-0.59)	(1.04)
Liquidity (Amihud)			0.116***	0.151***
			(5.44)	(6.98)
Profitability			-0.050**	-0.014
			(-2.41)	(-0.66)
Volatility			0.196***	0.230***
			(8.62)	(9.81)
Return			-0.045**	-0.074***
			(-2.18)	(-3.24)
Firm size			-0.241***	-0.219***
			(-12.13)	(-11.32)
Book-to-market			0.034*	0.071***
			(1.66)	(3.47)
Intercept	-0.011	0.145**	0.057***	0.189**
	(-0.76)	(2.12)	(3.40)	(2.36)
Year effects	No	Yes	No	Yes
Industry effects	No	Yes	No	Yes
Observations	4652	4652	3379	3379
F-statistic	84.88***	17.44***	61.93***	27.6***
Adj. R-squared	0.0157	0.0557	0.1256	0.1715

4.5.3. Dealing with endogeneity issues

A major concern in this study is endogeneity problems. Dividend policy decisions, of course, are not exogenous and may correlate with other omitted (unobserved) firm-specific variables that simultaneously determine dividends and systematic liquidity risk. In the presence of endogeneity, any estimates obtained using standard statistical approaches would be subject to a bias.

Using lagged independent variables in our main model alleviates but does not eliminate issues related to endogeneity in the OLS approach. Therefore, in order to further address the potential endogeneity issue, we conduct a two-stage regression approach using two alternative models, such as an IV regression model and Heckman-type two-step model (Heckman 1979).[63] These models involve two stages and allow recovering causal estimates in the presence of non-random assignment to treatment. In the first stage, the probability of being selected in the treatment group is estimated from exogenous instruments. In the second stage, the main model is estimated by adding a control variable that captures the difference between treatment and a control group resulting from unmodelled sources of variance in the selection process. Therefore, the correlation between the error term and selection is removed and consistent estimators can be obtained (see Antonakis et al. 2014).

IV regression model

The first method used to conduct the two-stage approach to address the potential endogeneity problem of dividends with respect to systematic liquidity risk is the IV regression model. In this model, the $Dividend\ policy_{i,t}$ dummy variables are treated as endogenous. Formally, the approach involves estimating the following models in two stages:[64]

$$Dividend\ policy_{it} = \gamma_0 + \gamma Z_{it} + \omega_{it} \tag{4.3}$$

[63] See Yu et al. (2009), Fernandes and Ferreira (2008) and Gul et al. (2010) for similar approaches to deal with endogeneity.
[64] See Gao et al. (2013) for an application of similar IV approaches in the context of public and private firms' cash policy.

$$\beta_{iliqi,t} = \gamma_0 + \gamma_1 Dividend\,policy^*_{it} + \gamma_2 X_{it} + \varepsilon_{it} \qquad (4.4)$$

In the first stage, we estimate a probit model (4.3), which captures the dividend policy (i.e., dividend payment decision (*DIV*) or the amount of dividends decision (*HighDPS*)). The second stage involves estimating model (4.4), in which systematic liquidity risk is regressed on the fitted values of the $Dividend\,policy$ dummy variable ($Dividend\,policy^*_{it}$), estimated from the first stage, and the control variables. As an instrumental variable for the $Dividend\,policy$ dummy variables, we use the industry-median dividend per share. We believe that this may be a valid instrument because an industry-level dividend may affect the dividend decisions of a given firm within that industry, but it is unlikely to have a direct impact on this firm's systematic liquidity risk.[65]

We present the IV regression results in Table 4.7.[66] Panel A presents the results for the dividend payment decision (*DIV*) where the first-stage regression results are in Column (1) and the second-stage regression results are in Column (2). The industry-median dividend variable in Column (1) is positive and significant, indicating that the higher the level of dividend within an industry, the more likely that a firm pays dividends.[67] The results in Column (2) suggest that dividend payers have a significantly lower systematic liquidity risk than non-payers. The coefficient on *DIV* is -0.52%, which is larger than that of the baseline regression (Table 4.4). This finding implies that failure to control for the endogeneity issue may underestimate the impact of the dividend payment decision on the systematic liquidity risk.

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[65] Similar studies that use industry-level variables as instruments are: Jiraporn et al. (2011) and Kini and Williams (2012).

[66] This was carried out using the treatreg command in STATA 13 since the endogenous variable is a dummy. The treatment regression considers the effect of an endogenously chosen binary treatment on another endogenous continuous variable (Cong and Drukker 2001).

[67] To test the validity of our instrument, we look at the first stage (see Larcker and Rusticus (2010:192) and Antonakis et al. (2014:32)). The first-stage F-tests that the instruments are jointly 0 exceed critical value for a weak instrument (F=8.96 for the case with one instrument) as developed in Stock et al. (2002). Moreover, our instrument is highly significant in the first-stage OLS regressions with a t-statistic of 2.10 and 3.36 for DIV and HighDPS, respectively. These alleviate the concern that our estimation suffers from bias introduced by having weak instruments.

Table 4.7 Dividend policy decisions and liquidity risk: endogeneity regressions

This table reports the results of the IV regression models (4.3) and (4.4), as well as the results of the Heckman model. Panel A represents the results for the dividend payment decision in which the DIV dummy variable, takes the value of 1 for dividend-paying firms, and 0 otherwise. Panel B represents the results for the amount of dividend decision in which HighDPS dummy variable takes the value of 1 for stocks with DPS higher than median, and 0 otherwise. Column (1) & (4) report the first-stage regression which is a probit regression with the DIV and HighDPS dummy being the dependent variable, respectively. We instrument for these variables using the industry–dividend median variable. IMR is the inverse Mills ratio in the Heckman model. All other variables are defined in the notes to Table 4.4. Columns (2)-(3) & (5)-(6) report the second stage regression of the IV and Heckman-type model, respectively. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Panel A: Dividend payers vs. Non-dividend payers

	Probit	IV regression	Heckman-type regression
	(1)	(2)	(3)
DIV		-0.519**	-0.993***
		(-2.78)	(-5.17)
Leverage	-0.058**	0.050***	0.046***
	(-2.18)	(2.97)	(2.72)
Liquidity (Amihud)	-0.257***	0.004	-0.029
	(-7.86)	(0.16)	(-1.17)
Profitability	0.587***	-0.024	0.045
	(12.79)	(-0.72)	(1.35)
Volatility	-0.198***	0.183***	0.158***
	(-7.37)	(8.13)	(7.19)
Return	-0.035	-0.077***	-0.080***
	(-1.24)	(-3.88)	(-4.09)
Firm size	0.628**	-0.166***	-0.146***
	(2.38)	(-8.25)	(-7.80)
Book-to-market	-0.098***	0.046**	0.035*
	(-3.65)	(2.33)	(1.18)
Industry–dividend median	0.655**		
	(2.10)		
Intercept	0.721***	0.451***	0.781***
	(4.74)	(3.09)	(5.16)
IMR			0.517***
			(4.71)
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Observations	4632	4632	4632
F/Chi2	820.44***	777.4***	927.03***
Pseudo R2/R2	0.306		0.173

Table 4.7 (Continued)

Panel B: High-dividend payers vs. Low-dividend payers			
	Probit	IV regression	Heckman-type regression
	(4)	(5)	(6)
HighDPS		-0.918***	-0.855**
		(-4.2)	(-2.27)
Leverage	0.029	0.024	0.023
	(1.14)	(1.18)	(1.19)
Liquidity (Amihud)	-0.352***	0.076**	0.082*
	(-7.89)	(2.51)	(1.93)
Profitability	0.206***	0.039	0.035
	(7.22)	(1.48)	(1.06)
Volatility	-0.046*	0.215***	0.216***
	(-1.70)	(8.71)	(8.84)
Return	0.026	-0.065***	-0.065***
	(0.99)	(-2.70)	(-2.82)
Firm size	0.187***	-0.179***	-0.183***
	(3.23)	(-8.55)	(-6.53)
Book-to-Market	-0.174***	0.024	0.027
	(-5.98)	(0.96)	(0.90)
Industry–dividend median	0.442***		
	(3.36)		
Intercept	-0.332**	0.679***	0.644***
	(-2.15)	(4.49)	(2.90)
IMR			0.436*
			(1.89)
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Observations	3379	3379	3379
F/Chi2	431.38***	756.57***	24.89***
Pseudo R2/R2	0.140		0.180

Panel (B) of Table 4.7 presents the results for the amount of dividend decision (*HighDPS*). The first-stage regression results are in Column (4) and the second-stage regression results are in Column (5). The results in Column (4) show that the industry-median dividend variable is positively and statistically significant, implying that the higher the level of dividend within an industry the more likely it is that a firm will pay a high amount of dividends. Column (5) shows that payers of a high amount of dividends have a significantly lower systematic liquidity risk than payers of a low amount of dividends. *HighDPS* has a negative coefficient of -0.92%, which is larger than that found in Table 4.5. This result indicates that failure to control for the endogeneity issue may underestimate the impact of the amount of dividend decision on the systematic liquidity risk.

Heckman-type two-step model

Our second model to conduct a two-stage regression approach is similar to that of Heckman (1979). The first stage of this estimation procedure involves a probit model that estimates the likelihood of a firm paying dividends/high amount dividends; see model (4.3). Then, the coefficient estimates obtained from the probit model are used to compute the Inverse Mills Ratios *(MR*s) (λ_{it}),[68] which are the probability density function (ϕ) divided by the cumulative distribution function of a distribution (Θ), for each observation in the sample:

for $Dividend\ policy_{it} = 1,\ \lambda_{it} = \frac{\phi(\delta Z_{it})}{\Theta(\delta Z_{it})}$ (4.5)

for $Dividend\ policy_{it} = 0,\ \lambda_{it} = -\frac{\phi(\delta Z_{it})}{1-\Theta(\delta Z_{it})}$ (4.6)

In the second stage of the estimation procedure we run our main multivariate regression (Model 4.2) while adding the estimated *IMR*s as an independent variable in order to account for the endogeneity and obtain consistent parameter estimates. The results are reported in Columns (3) and (6) of Table 4.7 for dividend payment decision (*DIV*) and amount of dividend decision (*HighDPS*), respectively. The coefficients on the *DIV* and *HighDPS* dummy variables continue to be negative and significant, indicating that the decision pay and the amount of dividend payments are negatively associated with liquidity risk. The statistical significance of the *IMR* implies that there exists endogeneity bias, and if we did not include it in the OLS regressions

[68] The *IMR* is an estimate of the non-selection hazard that addresses the probability of a stock with characteristics Z_{it} being a dividend payer/a high-dividend payer.

then the estimates would be biased and inconsistent. In summary, after controlling for the endogeneity of both dividend policy decisions, our main findings on the liquidity risk remain qualitatively unchanged. Dividend payers (payers of high dividends) have lower systematic liquidity risk than non-payers (payers of low dividends).

Table 4.8 Dividend policy decisions and liquidity risk: fixed-effects regressions

This table reports the results of the firm fixed-effect regressions. Panel A represents the results of the payment decision, which is measured by DIV, and Panel B represents the results of the amount of dividend decision, which is measured by both HighDPS (Column 2) and DPS (Column 3). DIV is a dummy variable that takes the value of 1 for dividend payers, and 0 otherwise. HighDPS is a dummy variable that takes the value of 1 for stocks with DPS higher than median, and 0 otherwise. DPS is the amount of dividend paid per share. The dependent variable is liquidity risk, estimated as the slope coefficient on LIQ while controlling for market returns where the regressions are estimated using the past five years of monthly data (with a minimum of 36 months). Liquidity is measured by the Amihud illiquidity ratio (Amihud). All other variables are defined in the notes to Table 4.4. All variables are standardized to have zero mean and unit variance. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Independent variable					
Panel A: Payment decision		**Panel B: Amount of dividend decision**			
(1)		**(2)**		**(3)**	
DIV	-0.139*	HighDPS	-0.180**	DPS	-0.116**
	(-1.83)		(-2.38)		(-2.29)
Leverage	0.080**	Leverage	0.054	Leverage	0.060
	(2.19)		(1.27)		(1.40)
Liquidity (Amihud)	0.012	Liquidity (Amihud)	0.054**	Liquidity (Amihud)	0.053**
	(0.58)		(2.47)		(2.43)
Profitability	-0.021	Profitability	-0.038	Profitability	-0.036
	(-0.93)		(-1.62)		(-1.49)
Volatility	0.069***	Volatility	0.052	Volatility	0.051
	(2.61)		(1.59)		(1.57)
Return	-0.042***	Return	-0.032*	Return	-0.036**
	(-2.95)		(-1.8)		(-2.02)
Firm size	-0.058	Firm size	-0.064	Firm size	-0.026
	(-1.46)		(-1.17)		(-0.47)
Book-to-market	-0.023	Book-to-market	-0.020	Book-to-market	-0.012
	(-0.76)		(-0.58)		(-0.36)
Intercept	0.246***	Intercept	0.219***	Intercept	0.114**
	(3.60)		(3.73)		(2.10)
Year effects	Yes	Year effects	Yes	Year effects	Yes
Observations	4632	Observations	3379	Observations	3379
F-statistic	4.22***	F-statistic	3.15***	F-statistic	3.20***
Adj. R-squared	0.039	Adj. R-squared	0.035	Adj. R-squared	0.035

Fixed-effects regression

Finally, to further address the concern that our results are subject to endogeneity issues due to omitted or unobserved factors that may affect the liquidity risk, we further perform a firm fixed-effects regression, which controls for unobservable characteristics that remain constant over time. Basically, a fixed-effects regression focuses only on the variation within firms over time, not the cross-sectional variation across firms. Li and Prabhala (2005) demonstrate that panel regressions with firm fixed effects can control for endogeneity stemming from unobserved attributes that are fixed over time. The results are reported in Table 4.8. The coefficients of all variables of dividend decisions remain significant. The fixed-effects result shows that, within firms, over time, both dividend policy decisions have a significant negative effect in systematic liquidity risk. This finding provides further support to our hypotheses (H3 and H4).

4.5.4. Additional robustness checks

Information effects

Here, we examine whether the impact of dividend policy decisions on systematic liquidity risk depends on the level of information opacity. The amount of information available can influence trading decisions of investors since they affect the level of uncertainty and adverse selection they face (Ng, 2011) and thereby affect systematic liquidity risk.

To test this prediction, we employ two commonly-used measures of amount of information, namely firm size and growth opportunities.[69] Large firms are typically better known and hence face lower information asymmetry and uncertainty (Frank and Goyal 2003; Leary and Michaely 2011). Growth firms are associated with more uncertainty and adverse selection as their

[69] Many studies use firm size and growth opportunities as proxies for the amount of information; see, e.g., Leary and Michaely (2011) and Bharath et al. (2009). Amount of available information can also be proxied by other variables such as analysts earning forecast; however, we are unable to use this proxy due to the lack of data availability and access to the I/B/E/S file.

managers seem to possess better information of the firm's investment opportunities and expected future cash follows (Smith and Watts 1992), and growth opportunities are more difficult for outsiders to value (Leary and Michaely 2011). Given that small, low-growth firms are associated with lower levels of information, we expect that uncertainty and adverse selection will be more severe in small and high-growth firms, as compared to large and low-growth firms. Therefore, investors are more likely to sell off the stocks of small and high-growth firms during low market liquidity and we therefore expect the effect of dividend policy on liquidity risk to be stronger in these firms.

In Table 4.9, we examine whether the dividend policy effect on systematic liquidity risk varies according to their growth opportunities and firm size using dummy variables and their interaction terms with DIV/HighDPS. The High dummy variable takes the value of 1 for observations with below the median book-to-market and 0 otherwise while the Large dummy variable take the value of 1 for observations above the median size and 0 otherwise. Panel A reports the results regarding the effect of whether the stock pays dividends or not (*DIV*), while Panel B reports the results of the effect of dividend amount (*HighDPS*). The results of Panel A show that firms with high growth and small firms tend to have more liquidity risk than those with the opposite characteristics. Further, within these groups of firms, those that are non-dividend payers have a higher level of liquidity risk. Non-dividend payers that are small and have high growth opportunities face higher degrees of information problems, which may explain why these firms have higher liquidity risk. Moreover, Panel B shows that firms with high growth and small firms tend to have more liquidity risk than those with the opposite characteristics. However, within these groups of firms, those that are non-dividend payers have a higher level of liquidity risk. Non-dividend payers that are small and have high growth opportunities face higher degrees of information problems, which may explain why these firms have higher liquidity risk.

Table 4.9 The effect of dividend policy on systematic liquidity risk and information opacity

This table presents the effect of dividend policy on liquidity risk conditional on growth opportunities and firm size as proxies for amount of information. The dependent variable is systematic liquidity risk, estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). DIV is a dummy variable that takes the value of 1 for dividend payers, and 0 otherwise. HighDPS is a dummy variable that takes the value of 1 for stocks with DPS higher than median, and 0 otherwise. DPS is the amount of dividends paid per share. Liquidity is measured by the Amihud illiquidity (Amihud). High is a dummy variable that takes the value of 1 for observations with above the median growth opportunities, and 0 otherwise. Large is a dummy variable that takes the value of 1 for observations with above the median size, and 0 otherwise. All other variables are defined in the notes to Table 4.4. All variables are standardized to have zero mean and unit variance. This table reports from the pooled regression with time and industry fixed effects. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Panel A: Dividend payers vs. Non-dividend payers			
Growth opportunities		**Firm size**	
DIV	-0.0561*	DIV	-0.0129**
	(-1.84)		(-1.98)
High	0.2089***	Large	-0.5310***
	(2.81)		(-7.53)
High*DIV	-0.3826***	Large*DIV	0.1726**
	(-4.98)		(2.27)
Leverage	0.0553***	Leverage	0.0886***
	(3.27)		(5.37)
Liquidity (Amihud)	0.0337	Liquidity (Amihud)	-0.0160
	(1.60)		(-0.77)
Profitability	-0.0706***	Profitability	-0.0644***
	(-3.35)		(-3.26)
Volatility	0.2021***	Volatility	0.1644***
	(9.96)		(8.12)
Return	-0.0768***	Return	-0.0382**
	(-3.96)		(-1.97)
Firm size	-0.1821***	Firm size	-0.1208***
	(-9.83)		(-9.22)
Book-to-market	0.0424*	Book-to-market	0.0291
	(1.85)		(1.53)
Intercept	0.0829	Intercept	0.4511***
	(1.05)		(5.87)
Year effects	Yes	Year effects	Yes
Industry effects	Yes	Industry effects	Yes
Observations	4631	Observations	4507
F-statistic	28.72***	F-statistic	55.58***
Adj. R-squared	0.1703	Adj. R-squared	0.2470

Table 4.9 (Continued)

Panel B: High-dividend payers vs. Low-dividend payers			
Growth opportunities		**Firm Size**	
HighDPS	-0.0812*	HighDPS	-0.0358*
	(-1.68)		(-1.70)
High	0.0512**	Large	-0.7429***
	(1.83)		(-15.04)
High*HighDPS	(-0.1238*	Large*HighDPS	0.0793*
	(-1.80)		(1.69)
Leverage	0.0177	Leverage	0.0768***
	(0.94)		(4.26)
Liquidity (Amihud)	0.1522***	Liquidity (Amihud)	0.0615***
	(6.87)		(2.90)
Profitability	-0.0045	Profitability	-0.0124
	(-0.22)		(-0.65)
Volatility	0.2289***	Volatility	0.1856***
	(9.77)		(8.18)
Return	-0.0719***	Return	-0.0375*
	(-3.16)		(-1.68)
Firm size	-0.2225***	Firm size	-0.1443***
	(-11.44)		(-9.83)
Book-to-Market	0.0358	Book-to-Market	0.0427**
	(1.42)		(2.16)
Intercept	0.2801***	Intercept	0.5650***
	(3.27)		(7.03)
Year effects	Yes	Year effects	Yes
Industry effects	Yes	Industry effects	Yes
Observations	3378	Observations	3286
F-statistic	25.62***	F-statistic	49.24***
Adj. R-squared	0.1740	Adj. R-squared	0.277598

Taken together, non-dividend payers that are small and have high growth options face higher degrees of asymmetric information and uncertainty, which may explain why these firms have higher liquidity risk. This finding is consistent with previous evidence documenting the impact of asymmetric information and uncertainty on liquidity risk. Small firms are likely to be associated with higher adverse selection and uncertainty since they have a lower amount of information than large firms. Moreover, high-growth firms also tend to be associated with lower levels of information and hence a higher degree of adverse selection and uncertainty, and investors are more likely to sell off their stocks in such firms. Therefore, investors are more likely to sell off these stocks at a discount during a period of low liquidity.

Alternative liquidity measures

Liquidity is multi-dimensional and is difficult to capture with a single proxy (Liu 2006; Banerjee et al. 2007; Vu et al. 2015). To address this concern, we consider another two measures of stock liquidity, namely, the proportional bid–ask spread and turnover ratio. Using these two measures, we construct another two liquidity factors (LIQ) and use them in the LCAPM to estimate liquidity betas and then re-estimate our main models of the relationship between liquidity betas and dividend policy decisions.

Table 4.10 Univariate analysis using alternative liquidity measures

This table presents the univariate analysis of the systematic liquidity risk of dividend payers and non-dividend payers as well as high-dividend- and low-dividend-paying stocks using the t-test for differences in mean and the Wilcoxon-Mann-Whitney test for differences in median. At each December between 2000 and 2013, the liquidity beta for each stock is computed. The liquidity beta is estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). Liquidity is measured by bid–ask spread (Spread) and turnover ratio (Turnover).

Panel A: Dividend payers vs. Non-dividend payers				
	Liquidity risk (Spread)		Liquidity risk (Turnover)	
	Mean	Median	Mean	Median
Dividend payers	0.605	0.427	0.678	0.447
Non-dividend payers	0.990	0.725	1.003	0.640
Mean test	13.457***		12.099***	
Median test		11.902***		9.171***
Panel B: High dividend payers vs. Low-dividend payers				
	Liquidity risk (Spread)		Liquidity risk (Turnover)	
	Mean	Median	Mean	Median
High-dividend payers	0.465	0.294	0.608	0.421
Low-dividend payers	0.738	0.551	0.738	0.478
Mean test	11.881***		6.487***	
Median test		11.514***		6.653***

In Table 4.10, Panel A shows that dividend payers have a mean systematic liquidity risk of 0.61 and 0.68 using bid–ask spread and turnover ratio, respectively, which is lower than that of non-dividend payers. In both cases, the difference in the systematic liquidity risk of the two groups is significant at 1% or better. This provides further evidence to support H3. Panel B shows that high-dividend payers have a mean systematic liquidity risk (0.47 in case of bid–ask spread and 0.61 in case of turnover ratio) that is lower (0.74 in case of bid–ask spread and 0.74 in case of turnover ratio) than that of low-dividend payers. These results provide a strong support to H4.

Table 4.11 presents the results of the regressions that examine how dividend payment decisions are associated with liquidity risk, which is measured using bid–ask spread and turnover ratio as alternative liquidity measures. Panel A reports the results for the dividend payment decision (*DIV*), Panel B reports the results for the amount of dividend payment decision (*HighDPS*) and Panel C reports the results for *DPS* as a continuous variable, respectively. The findings suggest that liquidity risk is negatively associated with dividend policy when other liquidity measures are used. However, the magnitude of the effect varies with different measures. For example, Panel A shows that based on liquidity risk estimated using bid–ask spread and turnover ratio, the coefficients on *DIV* are negative (-0.044 and -0.034, respectively), indicating that the liquidity risk of dividend payers is lower than that of non-payers. Consistent with the findings for the Amihud ratio, the results based on liquidity risk estimated from bid–ask spread and turnover ratio show that the difference in liquidity beta of those stocks that pay a high amount of dividend per share and their counterparts is 0.098 and 0.13, respectively (see Panel B). Furthermore, Panel C shows that the amount of dividend per share has a negative impact on liquidity risk. All of these differences are negative and statistically significant, supporting our hypotheses (H3 and H4), except for model in Column (1) in the case of bid–ask spread.

Overall, our results based on the alternative liquidity measures are similar to those based on our main measure (Amihud illiquidity ratio). Dividend payers and payers of high dividends continue to have lower liquidity risk than their counterparts.

Table 4.11 Multivariate analysis using alternative liquidity measures

This table reports the multivariate regression results for model (2), which captures the difference in systematic liquidity risk of dividend payers and non-dividend payers (Panel A), as well as high-dividend and low-dividend payers (Panel B). Panel C reports the impact of dividend per share on liquidity risk. Columns (1), (3), and (5) report the results using bid–ask spread as the liquidity measure. Columns (2), (4), and (6) report the results using turnover ratio as the liquidity measure. The dependent variable is liquidity risk, estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). DIV is a dummy variable that takes the value of 1 for dividend payers, and 0 otherwise. HighDPS is a dummy variable that takes the value of 1 for stocks with DPS higher than median, and 0 otherwise. DPS is the amount of dividends paid per share. Liquidity is measured by the bid–ask spread (Spread) and turnover ratio (Turnover). All other variables are defined in the notes to Table 4.4. All variables are standardized to have zero mean and unit variance. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Panel A: Dividend payers vs. Non-payers			**Panel B: High-dividend payers vs. Low-dividend payers**			**Panel C: Amount of dividends (DPS)**		
	Spread	**Turnover**		**Spread**	**Turnover**		**Spread**	**Turnover**
	(1)	**(2)**		**(3)**	**(4)**		**(5)**	**(6)**
DIV	-0.044	-0.337***	HighDPS	-0.098***	-0.125***	DPS	-0.041**	-0.039**
	(-1.02)	(-7.75)		(-2.82)	(-3.67)		(-2.38)	(-2.50)
Leverage	0.036**	-0.029*	Leverage	0.021	-0.062***	Leverage	0.023	-0.060***
	(2.08)	(-1.77)		(1.12)	(-3.40)		(1.26)	(-3.28)
Liquidity	0.125***	0.110***	Liquidity	0.234***	0.116***	Liquidity	0.240***	0.111***
	(5.99)	(6.15)		(10.69)	(5.20)		(11.17)	(5.04)
Profitability	-0.093***	-0.070***	Profitability	-0.016	-0.024	Profitability	-0.017	-0.029
	(-4.48)	(-3.11)		(-0.81)	(-1.22)		(-0.89)	(-1.45)
Volatility	0.201***	0.167***	Volatility	0.235***	0.195***	Volatility	0.236***	0.198***
	(10.07)	(8.03)		(10.43)	(7.71)		(10.48)	(7.78)
Return	-0.086***	-0.080***	Return	-0.083***	-0.092***	Return	-0.084***	-0.094***
	(-4.57)	(-4.43)		(-3.79)	(-4.32)		(-3.85)	(-4.42)
Firm size	-0.178***	-0.050***	Firm size	-0.199***	-0.055***	Firm size	-0.195***	-0.055***
	(-8.93)	(-5.05)		(-9.26)	(-4.14)		(-9.03)	(-4.01)
Book-to-market	0.019	0.040**	Book-to-market	0.035	0.054***	Book-to-market	0.037*	0.060***
	(1.03)	(2.17)		(1.69)	(2.67)		(1.81)	(2.97)
Intercept	0.02	-0.221***	Intercept	0.06	-0.409***	Intercept	0.011	-0.472***
	(0.29)	(-3.37)		-0.75	(-5.55)		-0.14	(-6.72)
Year effects	Yes	Yes	Year effects	Yes	Yes	Year effects	Yes	Yes
Industry effects	Yes	Yes	Industry effects	Yes	Yes	Industry effects	Yes	Yes
Observations	4710	4636	Observations	3450	3381	Observations	3450	3381
F-statistic	35.12***	31.28***	F-statistic	33.3***	18.55	F-statistic	33.76***	18.48***
Adj. R-squared	0.2017	0.1831	Adj. R-squared	0.2195	0.1451	Adj. R-squared	0.2188	0.1429

Alternative models to estimate systematic liquidity risk

As a robustness check, we re-estimate the liquidity beta using the three-factor model of Fama and French (1993), and the four-factor model while also including the liquidity factor (*LIQ)*. The three-factor model includes the market factor $(r_{mt} - r_{ft})$, the size factor (SMB), and the book-to-market factor (HML). The four-factor model includes the three Fama-French factors plus a momentum factor (MOM) as follows:[70]

$$r_{it} - r_{ft} = \propto_i + \beta_{mi}(r_{mt} - r_{ft}) + \beta_{iliqi}\, LIQ_t + \beta_{smbi}\, SMB_t + \beta_{hmli}\, HML_t + \varepsilon_{it} \quad (4.7)$$

$$r_{it} - r_{ft} = \propto_i + \beta_{mi}(r_{mt} - r_{ft}) + \beta_{iliqi}\, LIQ_t + \beta_{smbi}\, SMB_t + \beta_{hmli}\, HML_t + \beta_{momi}\, MOM_t + \varepsilon_{it} \quad (4.8)$$

where β_{smbi}, β_{hmli}, and β_{momi} are factor loadings on SMB_t, HML_t, and MOM_t, respectively; SMB_t is the size risk factor in month *t* and is computed as the difference in returns of portfolios of small and large firms; HML_t is the difference in returns between portfolios of high and low book-to-market stocks; MOM_t is the difference in returns of portfolios of winner stocks with high prior returns and loser stocks with low prior returns. The other parameters are already defined in section 4.4.1.

Table 4.12 reports the results from the univariate analysis. Panel A shows that dividend payers have a mean systematic liquidity risk of 0.18 and 0.16 using the liquidity beta from the three-factor model and four-factor model, respectively, which is lower than that of non-dividend payers. In both cases, the difference in the systematic liquidity risk of the two groups is significant, as confirmed by our statistical tests. This provides further evidence to support H3. Panel B shows that high-dividend payers have a mean systematic liquidity risk of 0.099 in the case of the three-factor model and 0.089 in the case of the four-factor model. These are lower than that of low-dividend payers, consistent with the prediction of H4.

[70] We obtain the monthly Fama-French factors and the momentum factor from Xfi Centre for Finance and Investment website, University of Exeter. See http://xfi.exeter.ac.uk/researchandpublications/portfoliosandfactors/index.php.

Table 4.12 Univariate analysis using liquidity beta estimated from alternative models

This table presents the univariate analysis of the systematic liquidity risk of dividend payers and non-dividend payers (Panel A) as well as high-dividend- and low-dividend-paying stocks (Panel B) using the t-test for differences in mean and Wilcoxon-Mann-Whitney test for differences in median. At each December between 2000 and 2013, the liquidity beta for each stock is computed as the slope coefficient on LIQ from the three Fama-French factors model and the four-factor model. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). Liquidity is measured by the Amihud illiquidity ratio.

Panel A: Dividend payers vs. Non-dividend payers				
	Liquidity risk (three-factor)		Liquidity risk (four-factor)	
	Mean	Median	Mean	Median
Dividend payers	0.1758	0.0232	0.1639	0.0230
Non-dividend payers	0.3882	0.1480	0.3401	0.0518
Mean test	7.6798***		6.3100***	
Median test		6.926***		5.028***
Panel B: High-dividend payers vs. Low-dividend payers				
	Liquidity risk (three-factor)		Liquidity risk (four-factor)	
	Mean	Median	Mean	Median
High-dividend payers	0.0985	0.0029	0.0888	0.0030
Low-dividend payers	0.2482	0.1012	0.2311	0.1023
Mean test	6.8039***		6.3841***	
Median test		6.825***		6.771***

Table 4.13 presents the results of the regressions that examine how dividend payment decisions are associated with the liquidity risk that is estimated using the three-factor and four-factor models. The coefficients on *DIV* in Panel A are negative (-0.038 for the three- and -0.041 for the four-factor model, respectively), indicating that the liquidity risk of dividend payers is lower than that of non-payers. However, the impact is not significant. Consistent with the findings based on liquidity risk estimated from the two-factor model (LCAPM), the results based on liquidity risk estimated from the three- and four-factor models show that the difference in liquidity beta of those stocks that pay a high amount of dividend per share and their counterparts is 0.11 and 0.12, respectively (see Panel B). Furthermore, Panel C shows that the amount of dividend per share has a negative impact on liquidity risk. All these findings are statistically significant, supporting our hypotheses (H4) which posits that the amount of dividend decision has a negative impact on liquidity risk.

Table 4.13 Multivariate analysis using liquidity beta estimated from alternative models

This table reports the multivariate regression results for model (2), which captures the difference in systematic liquidity risk of dividend payers and non-dividend payers (Panel A), as well as high-dividend and low-dividend payers (Panel B). Panel C reports the impact of dividend per share on liquidity risk. The dependent variable is liquidity risk, estimated as the slope coefficient on LIQ from the three Fama-French factors model and the four-factor model. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). DIV is a dummy variable that takes the value of 1 for dividend payers, and 0 otherwise. HighDPS is a dummy variable that takes the value of 1 for stocks with DPS higher than median, and 0 otherwise. DPS is the amount of dividend paid per share. Liquidity is measured by the Amihud illiquidity ratio (Amihud). All other variable are defined in the notes to Table 4.4. All variables are standardized to have zero mean and unit variance. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Panel A: Dividend payers vs. non-dividend payers			Panel B: High-dividend payers vs. low-dividend payers			Panel C: Amount of dividends (DPS)		
	Three-factor model	Four-factor model		Three-factor model	Four-factor model		Three-factor model	Four-factor model
	(1)	(2)		(3)	(4)		(5)	(6)
DIV	-0.038	-0.041	HighDPS	-0.113***	-0.117***	DPS	-0.051***	-0.054***
	(-0.79)	(-0.85)		(-2.96)	(-3.05)		(-2.78)	(-3.03)
Leverage	-0.001	0.008	Leverage	-0.008	0.007	Leverage	-0.005	0.01
	(-0.08)	(0.44)		(-0.42)	(0.37)		(-0.27)	(0.53)
Liquidity (Amihud)	0.039*	0.035	Liquidity (Amihud)	0.183	0.171	Liquidity (Amihud)	0.188***	0.176***
	(1.78)	(1.62)		(8.78)***	(8.28)***		(9.13)	(8.62)
Profitability	-0.028	0.007	Profitability	0.024	0.045**	Profitability	0.022	0.043**
	(-1.29)	(0.32)		(1.11)	(2.06)		(1.01)	(1.97)
Volatility	0.152***	0.140***	Volatility	0.167***	0.156***	Volatility	0.169***	0.158***
	(6.96)	(6.25)		(6.54)	(6.04)		(6.62)	(6.12)
Return	-0.089***	-0.076***	Return	-0.044*	-0.033	Return	-0.046*	-0.035
	(-4.26)	(-3.59)		(-1.79)	(-1.34)		(-1.87)	(-1.43)
Firm size	-0.054***	-0.058***	Firm size	-0.044**	-0.052***	Firm size	-0.040*	-0.048**
	(-4.36)	(-4.83)		(-2.18)	(-2.70)		(-1.94)	(-2.43)
Book-to-market	-0.013	-0.014	Book-to-market	0.005	0.018	Book-to-market	0.008	0.021
	(-0.61)	(-0.66)		(0.23)	(0.85)		(0.36)	(0.98)
Intercept	0.153***	0.199***	Intercept	0.193**	0.291***	Intercept	0.140*	0.237***
	(1.96)	(2.54)		(2.21)	(3.38)		(1.65)	(2.82)
Year effects	Yes	Yes	Year effects	Yes	Yes	Year effects	Yes	Yes
Industry effects	Yes	Yes	Industry effects	Yes	Yes	Industry effects	Yes	Yes
Observations	4723	4723	Observations	3460	3460	Observations	3460	3460
F-statistic	13.66***	10.25***	F-statistic	12.05***	10.8***	F-statistic	12.06***	10.81***
Adj. R-squared	0.0806	0.0575	Adj. R-squared	0.089	0.0759	Adj. R-squared	0.0885	0.0754

4.6. Conclusion

While researchers identify the role of liquidity risk in asset pricing, a significant and yet unanswered question is why some stocks are more exposed to changes in market liquidity than others. In this chapter, we examine whether firm's dividend policy affects its systematic liquidity risk. We focus on the two decisions of dividend policy, the decision to pay and the amount of dividend payment. We hypothesize that dividends are negatively related to systematic liquidity risk.

The empirical results provide strong evidence to support this hypothesis. Specifically, we find that dividend payers and payers of higher dividends exhibit lower systematic liquidity risk than their counterparts. We also find that the systematic liquidity risk decreases with the amount of dividend per share. These results are robust to various model specifications, estimation methods, and liquidity measures. Furthermore, our empirical results continue to hold in additional tests in which we control for the endogeneity associated with dividend decisions and simultaneity bias due to the joint determination of dividends and liquidity risk.

These results are consistent with the view that during periods of low market liquidity, investors demand for dividend-paying stocks, and thus the value of hese stocks relative to non-paying stocks, is higher (Banerjee et al. 2007). Banerjee et al. (2007) find that sensitivity of stock returns to aggregate liquidity declines after dividend initiations. We extend the results of Banerjee et al. (2007) in two ways. First, we examine whether their insight extends to dividend levels other than just initiations. After all, managers are more likely to face decisions related to dividend levels than initiations or omissions decisions (Li and Lie 2006), so any evidence held for dividends levels would provide clearer implications to financial managers. Second, we analyze the impact of dividend policy on liquidity risk using a firm-level analysis where we consider other factors that might affect liquidity risk. This would help us to understand whether, and why, individual firms display varying sensitivity to market liquidity.

The results also support the flight-to-quality phenomenon (Acharya and Pedersen 2005; Brunnermeier and Pedersen 2009) in which adverse liquidity shocks force investors to sell off assets that are associated with higher uncertainty, asymmetric information, and trading costs (in our case, non-/low-dividend-paying stocks), leading to a decline in asset prices. In further analyses, we provide some evidence that the effect of dividend policy decisions on liquidity risk is stronger for firms with a high level of information opacity. In particular, we find that the impact of being a dividend payer or a payer of high dividend on systematic liquidity risk is most pronounced for stocks of firms that are small and high-growth.

The results of this chapter make significant contributions to the increasingly important literature studying the impact of dividend policy on firm value. We introduce systematic liquidity risk as an important driver of firm value and suggest that dividend policy results in lower systematic liquidity risk due to lower levels of uncertainty, adverse selection, and trading costs. We show that dividend policy decisions can impact firm value by lowering the firm's systematic liquidity risk, which, in turn, lowers the cost of capital and increases firm value.

Chapter 5: Dividend Policy, Stock Price Informativeness and Stock Liquidity

5.1. Introduction

In the last decade, extensive research has been done to investigate the effects of stock markets on firm's corporate actions that stem from the informational role of stock prices. A great attention among finance researchers has been paid to answer this question. Actually, understanding whether and how information flows from the stock market to firms is of vital importance in order to properly assess the impact of financial markets on the firm. This is based on the fact that information does not flow freely among firms and investors and hence various types of information that are not known by managers can be aggregated into the stock prices through the trading activities of different investors (Grossman and Stiglitz 1980; Kyle 1985; Chen et al. 2007a; Kim and Cheong 2015). Therefore, market prices may incorporate some specific information which can help managers in the allocation of corporate resources more efficiently, and thus may contribute to increase firm value. Accordingly, the stock market can have real impact on corporate policies if managers observe information in the market with the aim of making better decisions.[71]

Current literature offers important insights into the links between stock prices and managerial corporate decisions. So far, the literature has focused mainly on the role of stock prices in guiding corporate investment and cash savings. Particularly, numerous studies document that managers use the information incorporated into stock prices when they decide on, e.g., corporate investment (Durnev et al. 2004; Luo 2005; Chen et al. 2007a; Bakke and Whited 2010), cash savings (Frésard 2012), and labour investment (Ben-Nasr and Alshwer 2016). However, to the extent that prices incorporate new information about the firm, this information should also affect other corporate decisions that managers have to make (Frésard 2012).

[71]See Bond, et al. (2012) for a comprehensive survey on the real effects of the stock markets from the informational role of market prices.

In this chapter, we extend this strand of literature by investigating whether the information contained in stock prices can have an effect on dividend decisions. In particular, we study whether more informative stock prices are associated with a lower level of dividends paid. Stock price informativeness may affect the amount of dividend paid in two ways. First, stock prices include information about future investment and growth opportunities, discount rates, and financing opportunities, which may affect dividend decisions (Bhattacharya 1979; Miller and Rock 1985; Fama and French 2001; Nissim and Ziv 2001; Grullon et al. 2002; Hoberg and Prabhala 2009; Abor and Bokpin 2010; Wang 2010; Ardestani et al. 2013). It is predicted that a low level of stock price informativeness is more likely to encourage firm managers to increase their dividend payments to provide positive signals about firms' prospects and future cash flows. This positive news is expected to increase investors' confidence regarding firm performance as suggested by prior studies. In contrast, when stock price informativeness is at a high level where investors are well informed about firms' potential performance and earnings, firm managers are more likely to distribute a low level of dividend payment. Second, since more informative stock prices are associated with better monitoring of managers (Holmström and Tirole 1993; Ferreira et al. 2011), firms with high informativeness may be less reliant on dividends as a discipline mechanism (Liu 2002; Jiraporn and Ning 2006; Chae et al. 2009; Esqueda 2016).

Recently, stock liquidity has been proposed to be significantly related to dividend policy. It has been documented that firms with illiquid stocks are more likely to pay dividends than liquid stocks (Banerjee et al., 2007; Brockman et al., 2008; Griffin, 2010; Kuo et al., 2013). According to these studies, when trading frictions exist, investors will have greater demand for cash dividends from the stocks they hold. In the absence of trading frictions, however, investors can cheaply create homemade dividends. As a result, firms with more (less) liquid stocks will be less (more) likely to pay dividends to their shareholders. Furthermore, stock liquidity can also relate to dividend policy through its relationship with asymmetric information level. Liquid stocks are associated with a lower level of asymmetric information (Glosten and Milgrom 1985; Kyle 1985). At a low level of asymmetric information, firms are less likely to pay dividends (Bhattacharya 1979; Miller and Rock 1985). Hence, dividends are more important for firms with illiquid stocks. Given that stock liquidity is important for dividend policy, we provide a further analysis on the possible role that stock liquidity can play in the price informativeness–dividend relationship.

A vital element to our analysis is to identify when stock prices cover more firm-specific information. In this chapter, we rely mainly on firm-specific return variation (or price non-synchronicity) as a measure of price informativeness. This measure was first proposed by Roll (1988) and computed based on the correlation between the stock's return and the market and industry returns. If a significant percentage of a stock return variation is not explained by market and industry movements, i.e., if firm-specific return variation is high, then the stock price is more likely to convey firm-specific information. An extensive research finds that firm-specific return variation and stock price informativeness are closely linked. Particularly, firm-specific return variation is associated with more information about future earnings aggregated in stock prices (Durnev et al. 2003) and with more efficient capital allocation (Wurgler 2000; Durnev et al. 2004).

Using a sample of UK firms over the period 1996-2013, we find that stock price informativeness is negatively related to amount of dividend paid. This implies that firm managers are more likely to maintain a relatively low level of dividends when investors are well informed of firms' future cash flows and prospects (i.e., when price informativeness is high). This result also suggests that managers are less likely to use dividends as a discipline mechanism, as more informative stock prices result in a better monitoring of managers (Ferreira et al. 2011). We also find that the effect of price informativeness on dividends is consistent with both the signalling and agency costs arguments. More specifically, we find that the relationship between price informativeness and dividends is only evident in small firms, which is consistent with the argument based on the signalling model. Small firms typically face greater asymmetric information and hence are more likely to use dividends for signalling purpose in order to reduce informational asymmetries. Moreover, there is evidence consistent with the argument based on the agency costs as the effect of price informativeness on dividends is only observed in low-growth firms and those with low leverage. Low-growth firms and less-levered firms face high agency costs due to more excess cash in the firm, which they should mitigate by paying higher dividends.

We perform several tests to ensure the robustness of our results. First, we re-estimate firm-specific return variation using the following models: (i) Brockman and Yan's (2009) model and (ii) Fama and French's (1993) three-factor model. We find that our results are robust to the use of alternative estimates of firm-specific return variations as measures of stock price informativeness. Second, our finding remains robust when we control for endogeneity issues. Endogeneity can result in biased and inconsistent estimates that make reliable inferences almost impossible (Roberts and Whited 2012). Potential sources of endogeneity can be unobservable heterogeneity, simultaneity, and the possibility that the stock price informativeness is a function of dividends as firms with a high level of dividend payment could have greater stock price informativeness. Indeed, the result remains qualitatively unchanged when we use the firm fixed-effects model, change-in-variables approach and dynamic Generalized Method of Moments (GMM) model to control for unobserved heterogeneity, simultaneity, and reverse causality.

In the second part of our analysis, we address the role of stock liquidity in the relationship between stock price informativeness and amount of dividend paid. Consistent with our predictions, we find that the negative relationship between stock price informativeness and amount of dividend paid is stronger for firms with illiquid stocks, confirming our conjecture that the impact of stock price informativeness on the signalling and monitoring role of dividends is stronger in firms with higher trading frictions and asymmetric information.

This chapter makes several contributions to the literature. First, this chapter contributes to the literature on dividend policy. Recent studies have significantly enhanced our understanding of the determinants of dividend policy and the capital market consequences of corporate dividend policy.

However, the literature has so far paid very little attention to whether and how capital markets affect dividend policy. By focusing on the role of stock prices on dividend policy, this chapter helps to fill part of this gap by adding stock price informativeness to the list of the determinants of amount of dividend paid by the firm. Dye and Sridhar (2002) note that in contrast to the usual view of the information flows between capital markets and firms as being one way (from firms to the capital markets), information also flows from capital markets to firms. Hence, corporate dividend policy both affects and is affected by capital markets. This chapter provides evidence in support of the effect of the informational content of stock prices on corporate dividend policy. In brief, this chapter highlights that the availability of information embedded in stock prices acts as a key determinant in explaining dividend policy.

Second, it adds to the growing literature on the informational content of market prices and the real effects of financial markets (e.g., Bond et al. 2012) by investigating whether managers' decision regarding the amount of dividends is influenced by the information content of prices. Some existing studies highlight the existence of an informative feedback going from the stock market to different corporate decisions such as investments (Chen et al. 2007a; Bakke and Whited 2010), cash savings (Frésard 2012), mergers and acquisitions (Luo 2005), and labour investments (Ben-Nasr and Alshwer 2016). This chapter contributes to this line of research by providing evidence that information contained in stock prices affects managers' decision on dividend policy, a means through which investor information is shown to affect other corporate decisions, including investments, mergers and acquisitions, and issues of debt (Allen and Michaely 2003).

Recently, De Cesari and Huang-Meier (2015) found that changes in quarterly dividends are positively related to abnormal returns, and this relationship is stronger when stock returns are more likely to convey new private information to managers. However, our study differs from De Cesari and Huang-Meier (2015) in that their focus is on how the sensitivity of dividend changes to abnormal returns varies with information in stock prices. We, however, focus on the direct effect of information in stock prices on dividend policy by studying the effects on amount of dividend paid. We propose that the information content of stock price affects firms' choice of dividends as a signalling device and as a monitoring mechanism. Based on the signalling model and agency costs model, we show that stock price informativeness affects firms' choice of dividends as a signalling device and as a monitoring mechanism. This adds a new explanation for using payout policies for signalling purposes (Bernheim and Wantz 1995; DeAngelo et al. 2000; Grullon et al. 2002; Hail et al. 2014) as well as contributes to the literature on the interaction between dividends and other monitoring mechanisms (Grinstein and Michaely 2005; Grullon and Michaely 2012; Al-Najjar and Belghitar 2014; Hoberg et al. 2014; Chang et al. 2016). To the best of our knowledge, this study is the first to examine the role of dividends as signalling and discipline mechanisms in the context of stock price informativeness.

Finally, we argue that stock liquidity may play a role in the impact of stock price informativeness on dividend decisions. More specifically, the association between stock price informativeness and dividends is likely to be stronger in illiquid firms. Our argument is motivated by the evidence of the greater importance of dividends for firms with illiquid stocks than those with liquid stocks. Firms with illiquid stocks are more likely to pay dividends than those with liquid stocks (Banerjee et al. 2007, Kuo et al. 2013). Moreover, firms with illiquid stocks are associated with a higher level of asymmetric information (Welker 1995; Richardson 2000), and hence the need for dividends to reduce it is more valuable in these firms. Therefore, we further contribute to the literature by examining the effect of stock liquidity on the price informativeness–dividend relationship.

The remainder of this chapter is structured as follows. Section 5.2 evaluates the extant theoretical and empirical literature on stock price informativeness. Section 5.3 develops the hypotheses regarding the association between stock price informativeness and dividend policy as well as trying to determine whether the relationship is dependent on stock liquidity. Section 5.4 describes our data and research methodology. We present our empirical findings in Section 5.5 and conclude the chapter in Section 5.6.

5.2. Related literature

5.2.1. Stock price informativeness

In this sub-section, we describe a main element of our empirical analysis which is the stock price informativeness.[72] Theoretically, all information is incorporated into stock prices by the end of the trading day (Kyle 1985). Public announcements and financial disclosures are incorporated into stock prices directly whereas private information collected by informed investors is integrated into stock prices through trading activity (Piotroski and Roulstone 2004; Heitzman and Klasa 2012). A stock return variation can be decomposed into three different components: a market-related variation, an industry-related variation, and a firm-specific variation. The former two components capture systematic variations while the last one measures firm-specific variation (price non-synchronicity) (Chen et al. 2007a). In this chapter, we use firm-specific stock return variation as a proxy for the informativeness of stock price.

The use of firm-specific return variation is based on a large bulk of empirical and theoretical literature. Roll (1988) was the first to document that a significant fraction of stock return variation is not explained by market movements. Roll (1988: 216) argues that "the extent to which stocks move together depends on the relative amounts of firm-level and market-level information capitalized into stock prices". Actually, stock prices move upon the arrival of new information, which gets embedded into stock prices through two ways. The first one is through adjustments of prices after the release of public information, e.g., news on macroeconomic conditions or earnings announcements. The second one occurs through the trading behaviour of investors who have private information.

Several studies find evidence consistent with the notion that a high level of stock price informativeness reflects more firm-specific information incorporated into price. Durnev et al. (2003) investigate the extent to which

[72] Stock price informativeness, price non-synchronicity and firm-specific return variation are used interchangeably in this chapter.

current returns reflect future earning for firms with high firm-specific return variation. They argue that the information that investors have is about the firm's future earnings. Consistent with this argument, they find that firm-specific return variation is highly correlated with future earnings indicating that stocks with more specific return variation incorporate more information about future earnings in their current prices. These stocks have prices that are more informative. Piotroski and Roulstone (2004:1120) define stock return synchronicity as "the extent to which market and industry returns explain variation in firm-level stock returns". They show that firms exhibiting low (high) stock return synchronicity, ceteris paribus, have a relatively higher amount of firm-specific (market-level and industry-level) information impounded into their stock prices. All of these studies provide evidence that high firm-specific return variation (price non-synchronicity) is associated with more informative stock prices.

5.2.2. Empirical findings related to stock price informativeness

The use of firm-specific stock return variation as a measure of the relative degree of information reflected in stock price is empirically supported by several studies in different areas. For example, Morck et al. (2000) show that firm-specific return variation is lower in emerging markets than developed markets due to the lack of property protection rights, which makes arbitrage and information-based trading less profitable. Moreover, they argue that in well-developed financial markets, traders are more able to collect information on individual firms, and hence, prices reflect more private information. In a related study, Jin and Myers (2006) show that countries with developed and transparent financial markets have high firm-specific return variation because informed traders have high motivation to search for and use private information.

A number of studies find that more efficient capital allocation is associated with high firm-specific return variation (Durnev et al. 2001; Durnev et al. 2004). Durnev et al. (2004) show that industries with higher firm-specific return variation are more likely to allocate capital more efficiently. They argue that the private information in prices, as measured by price non-synchronicity, enhances investment efficiency. Similar results are reported by Wurgler (2000) in countries with high firm-specific return. In the context of cross-listing, Fernandes and Ferreira (2008) show that firms that are cross-listed on US exchanges exhibit higher firm-specific return variation than non-cross-listed firms. They attribute this finding to the fact that a US cross-listing typically expands the set of informed investors. The findings in Fernandes and Ferreira (2008) help to explain why cross-listed firms in the US show higher investment sensitivity to stock prices than firms that were never cross-listed (Foucault and Frésard 2012). They argue that a cross-listing improves managers' dependence on stock prices because it makes stock prices more informative to them. Accordingly, US cross-listings that are more likely to enhance the informativeness of stock prices for managers exhibit a higher investment-to-price sensitivity.

With regards to the literature on corporate governance, Piotroski and Roulstone (2004) use price non-synchronicity and examine the amount of firm-specific information integrated into price as a result of the actions of insiders, institutional investors, and financial analysts. They find that trading activities of insiders and institutional investors result in more firm-specific information being provided to the market whereas more analyst activities result in more industry information. In a related study, Chan and Hameed (2006) use data from emerging markets and find that analyst following decreases price non-synchronicity. Ferreira and Laux (2007) examine the relationship between corporate governance and stock price informativeness and find that firms with fewer anti-takeover provisions exhibit higher levels of stock price informativeness. According to Brockman and Yan (2009), US firms with block ownership tend to have access to more precise firm-specific information at a lower cost as opposed to diffuse shareholders, leading to higher firm-specific return variation. Yu (2011) shows that stock price informativeness (measured by firm-specific return variation) increased with the quality of firm-level corporate governance. Gul et al. (2011) show a positive association between gender diversity in corporate boards and stock price informativeness for US firms. They argue that gender-diverse boards enhance stock price informativeness by improving voluntary public disclosures in large firms and by motivating the gathering of firm-specific information in small firms. Ding et al. (2013) examine the impact of mutual fund ownership on stock price informativeness in China and find a positive association between stock price informativeness and mutual fund ownership. Boubaker et al. (2014) examine the effect of controlling shareholders on stock price synchronicity in the context of France and find that stock price synchronicity increases with excess control, supporting the argument that controlling shareholders tend to disclose less firm-specific information to conceal opportunistic practices. Withisuphakorn and Jiraporn (2015) explore how powerful CEOs influence the extent of stock price informativeness and find that firms with more powerful CEOs experience lower stock price informativeness. This is consistent with the notion that more powerful CEOs are less likely to disclose information, resulting in more information asymmetry and therefore lower stock price informativeness.

In another strand of literature, Sami and Zhou (2008) find that price non-synchronicity increases around implementation of new auditing standards in China. Studies on the adoption of International Financial Reporting Standards (IFRS), including Beuselinck et al. (2009) and Kim and Shi (2012), find an increase in price non-synchronicity following IFRS adoption. They claim that the financial statements under IFRS are of better quality, as prices reflect more firm-specific information. Moreover, Haggard et al. (2008) find that firms tend to have higher price non-synchronicity when they have higher disclosure quality scores. Haggard et al. (2008) demonstrate that their finding is consistent with the study by Jin and Myers (2006), as greater firm transparency is shown to improve stock price informativeness.

All of the above studies provide indirect support for the use of firm-specific return variation (price non-synchronicity) as a measure of the relative amount of information impounded into prices.

5.3. Hypotheses development

5.3.1. Dividend policy and stock price informativeness

An existing strand of finance literature argues that stock markets can affect firms' corporate actions through the valuable information about their prospects incorporated in their own stock price (Dow and Gorton 1997; Subrahmanyam and Titman 1999). This idea originates from Hayek (1945), who suggests that stock prices efficiently incorporate information from various market participants and hence enable better allocation of resources that can benefit the whole economy. The incorporation of information is facilitated through the trading activity of different speculators and investors (Grossman and Stiglitz 1980; Kyle 1985).

Dow and Gorton (1997) and Subrahmanyam and Titman (1999) suggest that stock prices may contain some new information that managers do not have and managers, in turn, can benefit from this information to improve their corporate decisions. Dow and Gorton (1997) propose a model in which stock market traders hold vital information about the market value of future corporate investment opportunities that managers do not have and show that stock markets affect corporate investment by conveying valuable information to managers. In a similar vein, Subrahmanyam and Titman (1999) highlight that stock markets can lead financing decisions by communicating information to managers. They examine the relationships between the informational content of stock prices and firms' choice between private and public financing. They show that public financing is more beneficial in providing managers with information coming from the stock market. They attribute this to the fact that the aggregate information generated across many stock market participants could provide more meaningful signals and hence improve the allocation of scarce resources. Several other related studies, including Dye and Sridhar (2002), Goldstein and Guembel (2008), Foucault and Gehrig (2008), and Bond et al. (2012), show that financial markets do affect the real economy and are not just a sideshow.

Empirically, many studies document that corporate investment decisions are considerably influenced by the informational content of stock prices. For example, Durnev et al. (2004) show that firms tend to invest more efficiently when their stock price integrates more private information. Chen et al. (2007a) show that a firm's corporate investment is more sensitive to stock price when the stock price informativeness is higher. They explain this result as an indication that stock prices reveal new private information that managers extract and use when deciding on corporate investment. Consistent results are found by Bakke and Whited (2010) who examine whether corporate investment decisions are determined by private information incorporated in stock prices or caused by mispricing. They show that investment decisions are not influenced by stock market mispricing and that managers incorporate private investor information when making investment decisions. Foucault and Frésard (2012) use a sample of foreign firms that cross-list on US exchanges and find that their investments are more sensitive to price than non-cross-listed firms. They interpret this results as evidence that cross-listing helps managers to collect more information and hence make better investment decisions. Ben-Nasr and Alshwer (2016) extend this research by focusing on the investment in human capital. They show that higher stock price informativeness is associated with higher labour investment efficiency.

In other strands of literature, many studies also report that other corporate decisions are affected by the stock price informativeness. For example, Giammarino et al. (2004) document that the informational content of stock price can influence the acceptance of seasoned equity offering. Luo (2005) suggests that the abnormal returns around merger announcements are strong determinants of deal completion. He argues that the managers of the merging firm learn from observing the market reaction and adjust their actions accordingly. Frésard (2012) examines the effect of stock price informativeness on corporate cash savings and finds that cash savings are more sensitive to prices when the stock prices integrate more new information.

Existing literature also suggests that informative stock prices are associated with better corporate governance (Holmström and Tirole 1993; Ferreira et al. 2011). In particular, informative stock prices can improve external monitoring mechanisms by disciplining managers. For instance, the announcement of value-decreasing investments decreases the stock price, making the firm a takeover target. Therefore, managers would be less likely to undertake value-destroying projects since prices react negatively to such actions (Ben-Nasr and Alshwer 2016). Thus, stock markets play an important monitoring role (Ferreira et al. 2011). This point of view has been confirmed by Edmans et al. (2012), who show that stock prices have a significant impact on takeover activities. Their findings indicate that informative stock prices may discipline managers as they may be more likely to be replaced if the takeover succeeds (Holmström and Tirole 1993). Moreover, more informative stock prices may be associated with more efficient internal monitoring by the board of directors, since the latter learn new information from the stock market. In line with this view, Ferreira et al. (2011) conclude that more informative stock prices are associated with less board independence, indicating that stock price informativeness may reduce the monitoring role of the board.

In summary, the above discussion indicates the presence of an informational channel going from stock prices to managerial corporate decisions. However, existing research pays little attention to the impact of stock price informativeness on dividend policy decisions. Actually, to the extent that stock prices incorporate new and valuable information about firm fundamentals, informative stock prices are expected to impact the different decisions that managers have to take. Building on this intuition, this chapter argues that decisions on dividend policy are particularly expected to be affected by the information incorporated into stock prices. Specifically, we argue that managers' decisions on the amount of dividend payments are likely to be affected by the amount of information contained in their firms' stock prices. This argument is mainly motivated by the following. Firms can use dividends as a mechanism which sends information to investors in the market or to its shareholders (Bhattacharya 1979; Miller and Rock 1985). The information may reflect future cash flows, discount rates, and the strategies that the firm is employing in the short run or long run. Managers of the firm can signal to the market information with regards to its future prospects through dividends. Many studies, including Aivazian et al. (2003), Grullon et al. (2005), and Asem and Alam (2015), confirm that dividend policy conveys relevant information about the firm. Alternatively, more informative stock prices lead to better corporate decisions if stock prices provide information above and beyond what managers can acquire directly. Stock prices include information about future investment and growth opportunities (Dow and Gorton 1997), financing opportunities (Subrahmanyam and Titman 1999), and future earnings (Durnev et al. 2003; Jiang et al. 2009), which may affect dividend policy (Fama and French 2001; Grullon and Michaely 2002; Grullon et al. 2002). Thus, stock markets perform a valuable informational role which can affect the need for dividends for signalling purposes.

Additionally, Easterbrook (1984) suggests that dividends may reduce agency costs through increasing the firms' dependence on external financing and therefore exposing firms to outside monitoring. Also, there is evidence that dividends can be used as substitutes with other non-dividend monitoring mechanisms. Many studies have presented evidence consistent with dividend policy acting as a corporate monitoring vehicle, and with substitution effects between dividends and other alternative control devices, such as managerial ownership, leverage, and growth (see, e.g., Hansen et al. 1994; Noronha et al. 1996; Grullon and Michaely 2012; Hoberg et al. 2014; Chang et al. 2016). The information contained in stock prices can enhance external governance mechanism (Holmström and Tirole 1993; Ferreira et al. 2011). Information revealed by prices allows external monitoring mechanisms to operate more efficiently. For example, when prices decrease due to the announcement of value-destroying projects, the firm becomes a cheaper takeover target. Managers who value control would be less likely to undertake such value-destroying projects. Consequently, stock markets can play an important role in monitoring (Ferreira et al. 2011), which could reduce agency-related problems. An improvement in the external corporate governance reduces the role of dividends in controlling agency costs, leading to a decrease in dividends (Liu 2002; Jiraporn and Ning 2006; Chae et al. 2009; Esqueda 2016).

In sum, based on the asymmetric information and agency costs models of dividends, we predict that a lower level of stock price informativeness is more likely to induce managers to increase their dividend payments in order to provide positive signals about their firm’s future prospects and cash flows. This positive news is expected to increase investors’ confidence in view of the significance of dividends to firm performance as suggested by prior studies (Bhattacharya 1979; Miller and Rock 1985). In contrast, when stock price informativeness is high and investors are already well informed on the firm’s future prospects, managers are less likely to increase dividends further. Moreover, high levels of price informativeness can also enhance the monitoring of managers (i.e., reduce the agency problems), and thus managers are less likely to pay low dividends to reduce the agency-costs problems. Consequently, a negative relationship between stock price informativeness and dividend payments is predicted.

H5: There is a negative relationship between stock price informativeness and the level of dividend payment.

5.3.2. The role of stock liquidity

Firms’ trading environment can play a significant role in determining its dividend policy (Banerjee et al. 2007; Brockman et al. 2008; Griffin 2010; Kuo et al. 2013). The seminal work of Miller and Modigliani (1961) proposes that in perfect capital markets, the total value of the firm is independent of its dividend policy. This irrelevance proposition has produced a large number of studies questioning the assumptions placed in the perfect capital market condition. One of the main assumptions of the irrelevance proposition of dividends is that in markets without trading friction, investors with liquidity needs can create homemade dividends at no cost by selling the proper amount of their stockholdings in the firm. In other words, investors are indifferent between receiving a dollar of dividends and selling a dollar of their investment. However, trading friction commonly exists in financial markets.

Stocks that pay cash dividends enable investors to meet their liquidity needs with little or no trading and thus enable them to avoid trading costs.

In their paper, Banerjee et al. (2007) rely on the dividend irrelevance proposition to examine whether there is a link between firm dividend policy and stock liquidity. They find that in the US, firms with less liquid stocks (i.e. stocks with higher trading frictions, a high proportion of numbers of no trading days, and a high price impact of order flow) are more likely to pay dividends, relative to firms with more liquid stocks, after controlling for firm size, profitability, and growth opportunities. The explanation for this is that investors in markets with fewer trading frictions can cheaply meet their liquidity needs through the high trading activity of the firm's stock and thus are willing to accept low dividends. Hence, dividend policy is less important in firms with liquid stocks. Similar results are found by Kuo et al. (2013) who examine a large sample of firms representing 18 countries and find that stock liquidity is an important determinant of dividend policy in the USA, France, UK and other European markets, as the effect of stock liquidity is significant in these markets. Consistent results are found in Brockman et al. (2008) and Griffin (2010) who confirm that stock liquidity plays a significant role in dividend decisions. Therefore, it can be argued that given that dividend policy is more important for firms with illiquid stocks, the relationship between stock price informativeness and dividend policy is stronger in firms with illiquid stocks.

Moreover, trading environment and hence stock liquidity can also affect the relationship between dividend and stock price informativeness through its relationship to asymmetric information (Bardos 2011). At different points of time, managers can hold private information about the firm that investors do not have (Richardson 2000; Armstrong et al. 2010) leading to two main problems. The first relates to adverse selection or hidden information which results in a failure to detect the true value of the firm (Akerlof 1970; Healy and Palepu 2001). The second relates to moral hazard or hidden action which causes earnings management (Richardson 2000) and non-disclosure of information (Verrecchia 2001) to align with the personal interests of managers. Information asymmetry can also occur among different types of investors and creates an adverse selection problem, as informed investors tend to trade on firm-specific information whereas uninformed investors rely more on publicly available information (Brown and Hillegeist 2007). The asymmetry of information among different parties affects the efficiency and transparency of the capital markets (Armstrong et al. 2010). Therefore, it is important to decrease information asymmetry and in turn increase stock liquidity (Bushman and Smith 2001). Glosten and Milgrom (1985) argue that the information revelation increases with trading activity, as informed traders trade aggressively on their information advantage for stocks with a high trading activity. As such, firms with liquid stocks are expected to be associated with low information asymmetry (Welker 1995; Richardson 2000).

Given the relationship between information asymmetry and stock liquidity, this implies that a firm's stock liquidity is a crucial input that may affect the relationship between dividend payment and stock price informativeness. The intuition is that the lower level of asymmetric information in liquid stocks results in a lower need for dividends to convey information and monitor managers, and that dividend payment is expected to be more valuable for illiquid stocks that face more severe asymmetric information. The models of Bhattacharya (1979), John and Williams (1985), and Miller and Rock (1985) suggest a positive relation between information asymmetry and dividend policy. At a higher degree of information asymmetry (lower stock liquidity), there is more need for dividends. Therefore, the relationship between stock price informativeness and dividend policy is stronger in firms with illiquid stocks. The above reasoning leads to the following hypothesis:

H6: The relationship between stock price informativeness and the level of dividend payment is more likely to be stronger for firms with low stock liquidity.

5.4. Data and methodology

5.4.1. Data

Our sample consists of the annual constituents of the FTSE ALL SHARE index over the period 1996-2013. Both stocks that survived the entire study period and those delisted anytime during the study period are included in the analysis. As standard in the literature, we exclude financial and utilities firms.[73] After dropping observations with missing values, there are 8,019 firm-year observations remaining in our sample representing 1,039 firms. This sample includes firms that pay cash dividends as well as firms that do not pay cash dividends (see, e.g., Al-Malkawi 2008; Al-Najjar and Belghitar 2014; Jabouri 2016). Finally, all variables are winsorized at the 1st and 99th tails to alleviate the impact of outliers.

The primary dataset, which consists of both daily and annual data for all stocks (dead and live), is taken from DataStream. The daily data includes bid prices, ask prices, trading volume, market value and closing prices. As discussed in the following section, this daily data is used to calculate liquidity proxies: proportional bid–ask spread, turnover ratio, and Amihud's (2002) illiquidity ratio (price impact). We also obtain daily returns on UK three-month Treasury bills (the risk-free rate) and the return on FTSE ALL SHARE index. These data are used to estimate the stock price informativeness variable which is the firm-specific return variations as discussed in the following section. Finally, annual data on dividends and other accounting variables are also extracted from DataStream.

5.4.2. Model specification

The first hypothesis (H5) of this chapter examines whether the level of stock price informativeness determines the amount of dividend paid by a firm. This is empirically tested using the following regression:

[73] The selection criteria and distribution of the sample across time and industries are presented in Table 3.1.

$$DY_{it} = \beta_0 + \beta_1 \Psi_{it-1} + \gamma Controls_{it-1} + (YearDummies) + (IndustryDummies) + \varepsilon_{it} \quad (5.1)$$

where the dependent variable (DY_{it}) represents the amount of dividend paid measured by dividend yield of firm *i* in year *t*.[74] Following previous studies such as Deshmukh et al. (2013) and Jain and Chu (2014), we measure this variable as the dividend per share divided by price per share in year *t.*

The variable Ψ_{it-1} represents stock price informativeness, which is measured by firm-specific stock return variation (price non-synchronicity)[75] for firm *i* in the year *t-1*. By taking lagged stock price informativeness, we can reduce the problem of endogeneity (see, e.g., Ferreira et al. 2011; Ben-Nasr and Alshwer 2016). The endogeneity problem may occur in several ways. For example, the dependent variable might impact one or more independent variables, which are referred to as reverse causality. Additionally, independent variables may be correlated with the error term (Gujarati 2004; Wooldridge 2010). However, using the lagged values of independent variables helps alleviate both these problems, because the current dependent variable does not impact the lagged values of independent variables, and the lagged values of independent variables may highly correlate with the current independent variables, but not with the current error term.[76]

In this study, following previous studies, such as Chen et al. (2007a) and Frésard (2012), firm-specific stock return variation is measured based on a regression estimation of stock returns for each firm on the returns of the market index and industry returns as follows:

[74] In unreported results, we also examine the effect of price informativeness on the firm's probability to pay dividends using an independent dummy variable of 1 for dividend paying firms and 0 otherwise and find qualitatively similar results. More specifically, stocks of firm with low (high) price informativeness are more (less) likely to pay dividends.

[75] Finance researchers have very frequently used firm-specific return variation as a measure of stock price informativeness. See, e.g., Chen et al. (2007a), Bakke and Whited (2010), and Foucault and Fresard (2014) in the context of investments decisions, Fresard (2012) in the context of cash savings, Fernandes and Ferreira (2008) in the context of cross-listings, Ferreira and Laux (2007), and Ferreira et al. (2011) in the context of corporate governance.

[76] Alternative approaches to account for endogeneity concerns resulting from these two problems and others, e.g., dynamic endogeneity, are performed in the section of robustness checks.

$$r_{it} = \alpha_i + \beta_{i1} r_{mt} + \beta_{i2} r_{ind\square stryt} + e_{it} \quad (5.2)$$

where r_{it} is the stock return for firm *i* in day *t*, r_{mt} is the return of the market index, and $r_{industryt}$ is the industry returns. The market return is based on the FTSE ALL share index. The industry return is created using all firms within the same industry with firm *i*'s daily return omitted.[77] α_i and β_i are coefficients estimated for each year using regression analysis. In this model β_i is assumed to capture all systematic risk while idiosyncratic risk is the variance of e_{it}.[78]

We calculate the stock's relative firm-specific return variation as the ratio of idiosyncratic volatility to total volatility ($\sigma^2_{i,e,t}/\sigma^2_{i,t}$), which represents the percentage of volatility that is not explained by systematic components. It equals the value of $(1 - R^2_{it})$ from regression (5.2), where R^2_{it} is the coefficient of determination of firm *i* in year *t*. Since it is skewed and bounded within the intervals [0, 1] (Durnev et al. 2004), $(1 - R^2_{it})$ is not appropriate for use as a variable in regressions. Therefore, as recommended by Theil (1971), we apply logistic transformation of the ratio $(1 - R^2_{it})/R^2_{it}$ and generate an unbound continuous variable with a more normal distribution.[79] Formally, firm-specific stock return variation Ψ_{it} is defined as:

$$\Psi_{it} = \ln\left(\frac{1 - R^2_{it}}{R^2_{it}}\right) \quad (5.3)$$

where Ψ measures the firm-specific stock return variation relative to market-wide variation and R^2_{it} is the coefficient of determination of firm *i* in year *t*. Firm-specific stock return variation is scaled by total variation in returns, as firms in some industries are more subject to economy-wide shocks, resulting in firm-specific activities being more intense (Ferreira and Laux 2007; Fernandes and Ferreira 2008). Higher values for Ψ imply higher firm-specific stock return variation relative to market-wide and industry-wide variation

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[77] According to Durnev et al. (2004), this omission "prevents spurious correlation between firm and industry returns in industries that contain few firms". See, e.g., Gul et al. (2010); Fresard (2012); Chan and Chan (2014) for similar procedure.

[78] We have also computed firm-specific return variation using the Fama and French (1993) three-factor model and Brockman and Yan (2009) model. These results are given in the section of robustness checks.

[79] See also Morck et al. (2000), Durnev et al. (2004), Fernandes and Ferreira (2008), and Gul et al. (2011).

(higher price infromativeness) i.e., lower synchronicity with the market and the industry.[80]

Following prior research (e.g., Fama and French 2001; Fama and French 2002; Kim and Jang 2010; Jiraporn et al. 2011), our control variables ($Controls$) include profitability, growth opportunities, and leverage ratio. We provide a detailed discussion of these variables in Section 5.4.3. All control variables are lagged by one year. Year and industry dummies are included in the model to control for time and industry fixed effects. We note that our model is similar to that used by Ferreira et al. (2011) to investigate the effect of price informativeness on board structure and Ben-Nasr and Alshwer (2016) to investigate the effect of price informativeness on labour investments.

The coefficient α_0 is the intercept while coefficient β_1 is the coefficient of interest. The first hypothesis of this chapter (H5) posits that the stock price informativeness is negatively associated with the amount of dividend payment. Therefore, the sign for the coefficient for firm-specific stock return variation, represented by β_1, is predicted to be negative.

Next, to test the second hypothesis of this chapter (H6), we examine whether the relationship between stock price informativeness and dividend payment depends on the firm's stock liquidity. We test H2 by evaluating the interaction effect of price informativeness and the stock liquidity. For this purpose, we estimate the following regressions:

$$DY_{it} = \beta_0 + \beta_1\Psi_{it-1} + \beta_2 Liquidity_{it-1} + \beta_3\Psi_{it-1} * Liquidity_{it-1} + \gamma Controls_{it-1} + (YearDummies) + (IndustryDummies) + \varepsilon_{it} \quad (5.4)$$

where DY_{it} is dividend yield in year *t*, Ψ_{it-1} is stock price informativeness, which is measured by firm-specific stock return variation for firm *i* in the year *t-1,* and $Liquidity_{it-1}$ is stock liquidity. Prior studies have identified a number

[80] There might be a problem with the economic meaning of $\Psi = ln([1-R^2]/R^2)$. For example, doubling R^2 does not double Ψ. To address this and following some previous studies, e.g., Chen et al. (2007a), we repeat the regression using $\Psi = 1-R^2$ and we get qualitatively similar results.

of proxies to measure stock liquidity.[81] We measure stock liquidity using Amihud's illiquidity ratio measured for a given stock on a given day as the ratio of absolute percentage price change per dollar of daily trading volume (Amihud 2002). Hasbrouck (2009) finds that among the liquidity measures constructed from daily data, Amihud's illiquidity ratio is the best proxy for the high-frequency dynamic price impact measures of liquidity. Likewise, by comparing several measures of liquidity, Goyenko et al. (2009) conclude that Amihud's illiquidity ratio produces significant results in capturing the price impact of trade. They find that it is comparable to intraday estimates of price impact such as Kyle's lambda. Therefore, we use Amihud's illiquidity ratio as the main liquidity proxy in our study. However, for a robustness check, we use two additional measures of liquidity – proportional bid–ask spread and turnover ratio – to reflect trading costs and trading activity aspects of liquidity, respectively.[82]

In Equation (5.4), our focus is the coefficient β_3, which measures the sensitivity of the dividend/price informativeness relationship to the liquidity of the firm's stock. As H2 conjectures that the relationship between the stock price informativeness and the amount of dividend payment is likely to be stronger for illiquid stocks (stocks with high illiquidity ratio), then H2 is supported if β_1<0 and β_3<0. A negative value indicates that higher illiquidity ratio (low stock liquidity) is likely to increase the amount of dividends in firms with less informative stock price.

5.4.3. Control variables

Consistent with the literature, a set of control variables for the amount of dividend paid is used in this study, as these factors have been strongly documented to influence dividend payment decisions. Existing studies have identified profitability, growth opportunities, and leverage ratios as mainly determinants of dividend policy (see, e.g., Fama and French 2001; Benito and Young 2003; Denis and Osobov 2008; Fatemi and Bildik 2012; Michaely and Roberts 2012).

[81] See Goyenko et al. (2009) for more discussion.
[82] See Table 3.2 for measurements of the stock liquidity proxies.

Profitability

The higher the firm's profitability, the more cash available is for managers to spend. Thus, profitable firms are expected to pay dividends in order to reduce the agency costs of free cash flow (Easterbrook 1984; Jensen 1986). Consistent with this prediction, several studies show that firms with high profitability are more likely to pay dividends and have a higher payout ratio (see, e.g., Fama and French 2001; Aivazian et al. 2003; Denis and Osobov 2008; Brockman and Unlu 2009). Following Banerjee et al. (2007) and Amidu and Abor (2006), we measure firm profitability as the ratio of earnings before interest and taxes to total assets.

Growth opportunities

Rozeff (1982) and Myers and Majluf (1984) suggest that the firm's investment policy has a significant effect on its dividend policy as the costs of the external sources of finance will create competition between investment opportunities and dividend payments. Specifically, firms which have high growth opportunities may have lower dividend payments because new investments will consume large amounts of internally generated cash, which have lower costs than external funds. Firms which have high growth opportunities have profitable uses for their internal cash flows, and thus pay less dividends. This view is supported by the findings of many empirical studies (see, e.g., Fama and French 2001; DeAngelo et al. 2006; Brockman and Unlu 2009; Fuller and Blau 2010). Moreover, Barclay et al. (1997) argue that firms which have low investment opportunities would pay high dividends to reduce any overinvestment problem. However, firms which have high investment opportunities will have lower dividend payments to avoid the underinvestment problem because the cost of external sources of finance may prevent the firm from investing in positive net present value projects (Al-Malkawi 2008; Cheng et al. 2014). Therefore, a negative relationship is expected between growth opportunities and dividends. Following Fama and French (2001), Fama and French (2002), Banerjee et al. (2007), and Hussainey et al. (2011), growth opportunities are measured as the ratio of the percentage changes in total assets.

Leverage ratio

Many empirical studies have concluded that dividends are negatively affected by leverage (see, e.g., Faccio et al. 2001; Gugler and Yurtoglu 2003; Al-Malkawi 2007). These studies argue that firms with high leverage use internal cash flow to meet their financial obligations and protect their creditors instead of paying the existing cash to their shareholders (Aivazian et al. 2003). This view is consistent with the agency theory (Jensen and Meckling 1976), which suggests that dividends and leverage act as substitute mechanisms for mitigating agency conflicts. Jensen (1986) argues that firms can use debt as an alternative to dividends to reduce agency cost. Following Gugler and Yurtoglu (2003), Von Eije and Megginson (2008), Al-Najjar and Belghitar (2014), and Firth et al. (2016), this chapter employs total debt to total assets ratio as a proxy for leverage ratio.

5.5. Empirical results

5.5.1. Descriptive statistics

The descriptive statistics for all the variables included in our baseline specifications are presented in Table 5.1. The average value of dividend yield (DY) indicates that, on average, firms pay out £0.013 dividends relative to price share. The mean of Ψ is 2.75, which is higher than the 1.92 and 1.85 found by Frésard (2012) and De Cesari and Huang-Meier (2015) for US firms, respectively. This figure corresponds to an average firm's return-specific variation of 88% (1-R^2 in yearly firm-level return regressions). This number is comparable to the 83% reported by Chen et al. (2007a) in the context of US firms. It is worth noting that the average R^2 of the sample is 0.116. The low R^2 is consistent with Roll's (1988) finding that a large amount of stock price movement is driven by firm-specific information.[83] However,

[83] Roll et al. (1988) and Morck et al. (2000) interpret higher R^2 values (i.e., greater stock price synchronicity) as returns that reflect more market-wide information and lower R^2 values as returns that reflect more firm-specific information. A low R^2 is potentially due to firms' returns capturing unique firm-specific information or reflecting greater idiosyncratic noise (Roll, 1988).

the value is lower than the 0.193 reported by Piotroski and Roulstone (2004) in their sample of US firms.

The descriptive statistics for our control variables indicate that, on average, total liabilities represent 19.7% of total assets with a standard deviation of 0.177. These figures are comparable to those found by Al-Najjar and Belghitar (2014) in their sample. The percentage change in total assets is 5.6% and profitability ratio is 5.2%, indicating that earnings before interest and taxes represent 5.2% of total assets. This is comparable to the reported average value of 5.8% in Henry (2011) for an Australian sample.

Table 5.1 Descriptive statistics

This table shows the descriptive statistics for the dependent and independent variables used in the study. DY is the dividend yield. $\Psi = ln\,((1 - R^2)/R^2)$, where R^2 is from a regression of the daily stock returns on daily market and industry returns. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is the percentage change in total assets.

	Mean	SD	Median	Min	Max
DY	0.013	0.016	0.009	0.000	0.090
Ψ	2.745	1.538	2.631	-0.299	7.167
R^2	0.116	0.129	0.067	0.001	0.572
Leverage	0.197	0.177	0.172	0.000	0.835
Profitability	0.052	0.182	0.083	-0.923	0.389
Growth	0.056	0.271	0.054	-1.128	0.800

Table 5.2 Correlation matrix

This table reports the Pearson pairwise correlation coefficients between the regression variables. DY is the dividend yield. $\Psi = ln\,((1 - R^2)/R^2)$, where R^2 is from a regression of the daily stock returns on daily market and industry returns. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is the percentage change in total assets.

	DY	Infor	Leverage	Profitability	Growth	VIF
DY	1					
Ψ	-0.2146***	1				1.02
Leverage	0.0812***	-0.0226**	1			1.00
Profitability	0.3010***	-0.1283***	0.001	1		1.23
Growth	0.0549***	-0.0975***	-0.0239**	0.4510***	1	1.22

Table 5.2 reports the Pearson correlation coefficients between *DY*, Ψ and the control variables. Consistent with our hypothesis (H5), we find that Ψ is significantly and negatively correlated with *DY* at the 1% level, implying that more informative stock prices lead to a lower level of dividend. As for the control variables, we find several significant correlations which are consistent with prior related dividend literature. In fact, *DY* is positively and significantly correlated at the 1% level with profitability, indicating that profitable firms pay a higher level of dividends (Jabbouri 2016). Furthermore, *DY* is positively and significantly correlated with leverage and growth opportunities. This result is counter to the theory. However, these results should be interpreted with caution because the analysis is conducted on each variable in isolation and further examined under multivariate analysis, which is presented later. Ψ is negatively correlated with *Leverage*, indicating that higher leverage firms have lower firm-specific return variation (e.g., Fernandes and Ferriera 2008; Kim and Shi 2012). Similarly, a negative correlation is found between Ψ and *Growth*, suggesting that growth firms have lower firm-specific return variation (Ferriera and Laux 2007; Ben-Nasr and Alshwer 2016). Further, consistent with Gul et al. (2011) and Ben-Nasr and Cosset (2014), more profitable firms tend to have less informative stock prices as the correlation between Ψ and *Profitability* is negative. In general, we report low correlation coefficients between Ψ and the control variables, thus alleviating multicollinearity concerns that may affect our regression results. The highest correlation between the explanatory variables is 0.45, which is considerably less than the 0.80 threshold above which multicollinearity threats could arise (Gujarati 2004). To assess more directly whether the sample suffers from multicollinearity, the Variance Inflation Factors (VIF) for each of the explanatory variables were calculated. We find no indication of a multicollinearity problem as the values of the VIF of the explanatory variables are found to be less than the cut-off value of 10 (Gujarati 2004).

5.5.2. Dividends and stock price informativeness

5.5.2.1. Main regression results

Table 5.3 presents the results from several specifications of the dividend yield regression both with a restricted and a full set of explanatory variables. Column (1) presents the results of an OLS univariate regression of dividend yield on Ψ. There is strong evidence of a negative and significant relation between dividend yield and Ψ. The estimated Ψ coefficient is -0.0024. This effect is also economically significant: a one-standard deviation increase in Ψ predicts a decrease in dividend yield (*DY*) of 23.07% standard deviations.[84] In Column (2), we include industry and year dummies to control for unobserved industry and time fixed effects. The effect of Ψ remains negative and statistically significant. These findings support our hypothesis (H4).

Controlling for firm characteristics that are related to dividend yield (*DY*) does not change the qualitative results, although the coefficients and the robust t-statistics are attenuated. Column (3) of Table 5.3 reports the estimates for such a case. The estimated coefficient on Ψ in Column (3) is -0.0020. In Column (4), we further control for industry and time effects. The results show that Ψ is still significantly negative, consistent with the predictions of H5. We conclude that stock price informativeness displays a statistically significant negative relationship with the level of dividend paid. After controlling for firm characteristics and potential heterogeneity across industries and years, we find that a one standard deviation increase in Ψ is associated with a decrease in dividend yield of 20.19% standard deviation.[85]

[84] Table 5.1 indicates that the standard deviation of DY is 0.016 and the standard deviation of Ψ is 1.538. The coefficient for Ψ is equal to -0.0024. Thus, a one standard deviation increase in Ψ is associated with a 23.07% standard deviation decrease in dividend yield (1.538*-0.0024/0.016)=-0.2307).

[85] The coefficient for Ψ is equal to -0.0021. Thus, a one standard deviation increase in Ψ is associated with a 20.19% standard deviation decrease in dividend yield (1.538*-0.0021/0.016) = -0.2019).

Table 5.3 Dividends and stock price informativeness: main regression results

The table reports the baseline regression results regarding the effect of stock price informativeness on amount of dividend payment. The dependent variable is DY measured by the dividend yield. $\Psi = ln\left((1-R^2)/R^2\right)$, where R^2 is from a regression of the daily stock returns on daily market and industry returns. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is the percentage change in total assets. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Ψ	-0.0024***	-0.0024***	-0.0020***	-0.0021***
	(-18.02)	(-18.03)	(-15.94)	(-16.48)
Leverage			-0.0056***	-0.0039***
			(-5.65)	(-4.05)
Profitability			0.0293***	0.0250***
			(32.00)	(23.71)
Growth			-0.0054***	-0.0037***
			-8.19	-5.43
Intercept	0.0202***	0.0209***	0.01684***	0.0173***
	(46.31)	(21.41)	(36.89)	(17.84)
Year effects	No	Yes	No	Yes
Industry effects	No	Yes	No	Yes
Observations	6980	6980	6980	6980
F-statistic	324.73***	47.27***	362.59***	76.52***
Adj. R-squared	0.0495	0.1193	0.1456	0.1806

Our findings indicate that the increase in the information flow to the market leads to firms paying a lower amount of dividends. The explanation is that when stock prices are more informative about what is happening inside the firm (i.e., stock prices incorporate more information about future investment and growth opportunities, future relationship with stakeholders, and financing policies), this leads to a reduction in the informational role of dividends, as investors are already well informed and hence managers are less likely to pay dividends. Another explanation for our finding is that informative stock prices can act as a disciplinary mechanism of managers, and hence lead to better monitoring, which mitigate the agency problem, resulting in less of a need to use dividends as a means to reduce agency problem.

Regarding the control variables, we obtain results consistent with our expectations and previous empirical findings. The negative coefficient on leverage ratio is consistent with our prediction. It reinforces the conclusions of Jensen (1986) that leverage is a substitute for cash dividend in reducing agency costs and information asymmetry. Similar results are reported by Faccio et al. (2001), Aivazian et al. (2003), Gugler and Yurtoglu (2003), and Al-Malkawi (2008). As expected, the results reveal a negative relationship between growth opportunities and dividends since growth opportunities would exhaust cash available for dividend payments (Rozeff 1982; Fama and French 2002; Brockman and Unlu 2009). Moreover, paying low dividends is a means to sustain growth and decrease firms' reliance on costly external financing (Dempsey and Laber 1992; Manos 2003; Abor and Bokpin 2010). Profitability is positively related to dividends, in line with previous research (Fama and French 2002; Aivazian et al. 2003; Al-Malkawi 2008; Brockman and Unlu 2009). This relationship is consistent with the signalling theory of dividends (Bhattacharya 1979; John and Williams 1985; Miller and Rock 1985) which argues that managers pay larger dividends to signal a firm's future profitability to the investors. It is also consistent with the view that the higher the firm's profitability, the more cash is available for managers to spend; hence, more profitable firms would be more likely to pay high dividends to decrease the agency costs of free cash flow (Easterbrook 1984; Jensen 1986; Firth et al. 2016).

5.5.2.2. Firm characteristics

In this section, we examine whether the negative relationship between dividends and stock price informativeness is consistent with the arguments based on signalling and/or agency costs. If dividend signalling and monitoring roles become less valuable, we expect a weaker relationship. Firms with higher levels of asymmetric information tend to hold higher levels of dividends for signalling purposes (Michaely and Roberts 2011). We expect the impact of stock price informativeness on dividends to be more pronounced for firms with higher levels of asymmetric information. To test this prediction, we employ two commonly-used measures of asymmetric information, namely firm size and growth opportunities (e.g., Bharath et al. 2009; Leary and Michaely 2011); small- and high-growth firms are expected to have more asymmetric information.

In Columns (1) and (2) of Table 5.4, we divide our sample into two sub-samples of large and small firms. The results in Column (1) show no evidence of a statistically significant relationship between stock price informativeness and dividend yield in large firms. In Column (2), however, there is a statistically significant relationship. This suggests that the negative effect of price informativeness on dividends is only evident in small firms, consistent with the signalling model. In Columns (3) and (4), we examine whether the effect of stock price informativeness on dividends varies with growth opportunities. The results show that the effect of the stock price informativeness on dividends is only seen in low-growth firms. Given that low-growth firms are likely to have lower asymmetric information (Bharath et al. 2009; Leary and Michaely 2011), this finding is inconsistent with our prediction based on the signalling model.

On the other hand, as reviewed previously, agency theory suggests that the role of dividends as a monitoring role is more valuable in firms facing higher agency costs. Firms with low growth opportunities are facing higher agency costs since they are likely to have an overinvestment problem. Therefore, by paying dividends firms can limit management’s policy of overinvesting and hence enhance monitoring of managers (see Jensen 1986; Lang and Litzenberger 1989). This implies that firms facing higher agency costs should experience a more pronounced effect of stock price informativeness on dividends. Since growth opportunities can also be used as a proxy for the agency costs, our results in Columns (3) and (4), which show that effect of stock price informativeness on dividends only evident in low-growth, are consistent with the agency costs’ prediction. We further re-examine this prediction by using another measure of the agency costs. Firms with low debt are less subject to monitoring by capital markets and thus associated with higher agency problems, leading to more needs for dividends. As suggested by Jensen (1986), debt can act as a means to reduce the agency costs of free cash flow. Specifically, when a firm obtains debt, it makes a fixed commitment to creditors, which reduces the funds available to managers and subjects them to the scrutiny of debt suppliers. This implies that highly levered firms are expected to have low dividend payouts (Leary and Michaely 2011). The results are reported in Columns (5) and (6). They show that while the stock price informativeness has a significantly negative effect on dividends for firms with low leverage, there is no evidence of this effect for firms with high leverage. Less-levered firms have higher agency costs and hence tend to pay higher dividends.

To sum up, the effect of stock price informativeness on dividends is found to be significant only in small, low-growth, and less-levered firms, which is consistent with the arguments based on both signalling and agency costs.

Table 5.4 Dividends and stock price informativeness: firm characteristics

This table presents the effect of stock price informativeness on dividends controlling for firm size, growth opportunities, and leverage ratio. Columns (1) and (2) present the models for the two sub-samples of firms with a size above and below the median. Columns (3) and (4) present the models for the two sub-samples of firms with growth opportunities above and below the median. Columns (5) and (6) present the models for the two sub-samples of firms with a leverage ratio above and below the median. The dependent variable is DY measured by the. $\Psi = ln\ ((1 - R^2)/R^2)$, where R^2 is from a regression of the daily stock returns on daily market and industry returns. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is the percentage change in total assets. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	Firm size		Growth opportunities		Leverage ratio	
	Large	Small	High growth	Low growth	High leverage	Low leverage
	(1)	(2)	(3)	(4)	(5)	(6)
Ψ	-0.0017	-0.0005***	-0.0020	-0.0021***	-0.0021	-0.0019***
	(-1.59)	(-4.09)	(-0.86)	(-11.91)	(-0.63)	(-11.65)
Leverage	0.0030**	-0.0036***	0.0074***	0.0019	-0.0036**	0.0038*
	(1.96)	(-3.00)	(5.05)	(1.43)	(-2.29)	(1.68)
Profitability	0.0436524***	0.0172***	0.0240***	0.0255***	0.0294***	0.0231***
	(13.43)	(18.54)	(16.34)	(16.9)	(14.93)	(18.3)
Growth	-0.0059***	-0.0019***	-0.0061***	-0.0021**	-0.0020*	-0.0051***
	(-4.77)	(-2.68)	(-6.12)	(-2.23)	(-1.76)	(-6.55)
Intercept	0.0165***	0.0087***	0.0173***	0.0169***	0.0189***	0.0165***
	(11.81)	(8.29)	(12.92)	(12.07)	(14.08)	(11.86)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3614	3366	3408	3572	3531	3449
F-statistic	17.50***	44.06***	41.92***	39.44***	25.00***	52.47***
Adj. R-squared	0.1303	0.1708	0.1761	0.1962	0.1504	0.2225

5.5.2.3. Robustness checks

Alternative measures of firm-specific return variation

As a robustness check, we use two different firm-specific return variation proxies of stock price informativeness. Firstly, the firm-specific return variation (stock price informativeness) is re-estimated using Brockman and Yan's (2009) model. We regress the firms' daily return on contemporaneous and lagged daily market return, as well as contemporaneous and lagged daily industry return for each firm-year observation, as indicated in Equation 5.5.[86]

$$r_{it} = \alpha_i + \beta_{i1} r_{mt} + \beta_{i2} r_{mt-1} + \beta_{i3} r_{indust} + \beta_{i4} r_{indust-1} + e_{it} \qquad (5.5)$$

where r_{it} is the return of stock *i* in day *t*, r_{mt} is the contemporaneous daily market return, r_{mt-1} is the lagged daily market return, r_{indust} is the contemporaneous daily industry return, and r_{indust} is the lagged daily industry return. The industry return for a specific day is created using all firms within the same industry excluding firm *i*'s return. Lagged market and industry return is included in the regression to control for informed trading that can affect the timing of incorporation of the market and industry information into stock prices (Piotroski and Roulstone 2004; Chen et al. 2007a; Brockman and Yan 2009; Frésard 2012; Ben-Nasr and Alshwer 2016).

Secondly, following Ferreira et al. (2011), Gul et al. (2011), Frésard (2012), and Ben-Nasr and Alshwer (2016), the annual firm-specific return variation (price informativeness) is estimated by using the Fama and French three-factor model. In particular, we regress the excess return, which is the difference between daily stock return and the risk-free rate, of each firm in our sample on the three factors from the model of Fama and French:

$$r_{it} - r_{ft} = \alpha_i + \beta_{i1} MKT_t + \beta_{i2} SML_t + \beta_{i3} HML_t + e_{it} \qquad (5.6)$$

[86] Such an approach was adopted by many studies including Ben-Nasr and Alshwer (2016), Fresard (2012), Gul et al. (2010), and Chen et al. (2007a).

where r_{it} is the return of stock *i* in day *t*, r_{ft} is the risk-free rate in day *t*[87], MKT_t is the market excess return in day *t*[88], SML_t is the size risk factor in day *t* calculated as the difference between the daily returns of a portfolio of small vs. large firms, and HML_t is the high-minus-low book-to-market factor daily return.[89] Frésard (2012) argues that those factors are part of the systematic variation in individual returns.

Table 5.5 Dividends and stock price informativeness: alternative measures of stock price informativeness

This table reports the regression results of our main model using alternative measures of firm-specific return variations (Ψ). $\Psi = ln\,((1-R^2)/R^2)$, where R^2 in Column (1) is estimated using Brockman and Yan (2011) model and in Column (2) is estimated using the Fama and French (1993) model. The dependent variable is DY measured by. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is the percentage change in total assets. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	(1)	(2)
Ψ	-0.0026***	-0.0018***
	(-16.62)	(-14.02)
Leverage	0.0039***	0.0041***
	(4.06)	(4.48)
Profitability	0.0250***	0.0255***
	(23.69)	(26.35)
Growth	-0.0038***	-0.0026***
	(-5.56)	(-3.94)
Intercept	0.0180***	0.0149***
	(18.42)	(16.47)
Year effects	Yes	Yes
Industry effects	Yes	Yes
Observations	6977	8521
F-statistic	77.04***	87.66***
Adj. R-squared	0.1825	0.1660

Table 5.5 tabulates the results using alternative measures of firm-specific returns variation. Columns (1) and (2) show the results for the regression using the logistic transformation of the annual firm-specific return variation

[87] Risk-free rate is based on three-month UK T-bills and obtained from the DataStream.
[88] MKT is the difference between the return on the FTSE All SHARES index and the risk-free rate.
[89] The data on the Fama and French three-factor model (1993) is obtained from Xfi Centre for Finance and Investment website, University of Exeter.
See: http://xfi.exeter.ac.uk/researchandpublications/portfoliosandfactors/index.php.

(Ψ) estimated using the Brockman and Yan (2009) model and Fama and French (1993) model as the measure of price informativeness, respectively. The coefficients on Ψ are negative and significant at the 1% level, implying that firms with high price informativeness tend to pay less dividend. The effect of the alternative price informativeness measures on dividends is economically significant. A one standard deviation increase in firm-specific return variation reduces the level of dividends by roughly 20.74% (Column 1)[90] and 16.63% (Column 2)[91], respectively.

Endogeneity issues

In this sub-section, we address issues related to endogeneity. It is possible that amount of dividend paid and stock price informativeness are endogenously determined, as firms with a high level of dividend payment could have greater stock price informativeness. In addition, the relationships could be spuriously caused by some omitted variables. As mentioned previously, using lagged independent variables in our main model alleviates but does not eliminate issues related to endogeneity in the OLS approach. Therefore, in order to better tackle the potential endogeneity issue, we conduct additional tests including a change-in-variables model[92], firm fixed-effects model[93] and the Generalized Method of Moments (GMM) system two-step model.

First, we regress the changes in the dividend yield on the changes in the firm-specific information proxy and changes in the other explanatory variables. The change-in-variables, or first differencing, approach explicitly considers how changes in firm-specific information affect changes in

[90] This corresponds to a standard deviation of Ψ of 1.276 and a standard deviation of DY of 0.016.

[91] This corresponds to a standard deviation of Ψ of 1.454 and a standard deviation of DY of 0.016.

[92] Change-in-variables model has been used widely to control for endogeneity. See, e.g., Chan et al. (2013) in the context of stock return synchronicity and stock liquidity, Chang et al. (2015) in the context of institutional ownership and dividends, Chung et al. (2010), and Prommin et al. (2014) in the context of corporate governance and stock liquidity.

[93] See, e.g., Ferreira et al. (2011); Ben-Nasr and Cosset (2014); Chang et al. (2015); Ben-Nasr and Alshwer (2016); and Firth et al. (2016) which use the firm fixed-effects model to control for endogeneity.

dividend payment over time.[94] This model specification reduces concerns about omitted variables in our previous (levels) specification. Klock et al. (2005) suggest this method as appropriate to mitigate a potential feedback problem. Moreover, Chung et al. (2010) suggest that this method is more likely to provide better estimates than using level variables. The change model can be empirically tested using the following regression:

$$\Delta DY_{it} = \alpha_t + \beta_1 \Delta \Psi_{it-1} + \gamma \Delta Controls_{it-1} + \varepsilon_{it} \qquad (5.7)$$

where ΔDY_{it} is changes in dividend yield of firm *i* from year *t-1 to* year *t,* $\Delta\Psi_{it-1}$ is changes in firm-specific return variation from year *t-2* to year *t-1,* and $\Delta Controls$ is changes in a set of control variables from year *t-2* to year *t-1*. Year and industry dummies are included in the model while ε_{it} is unspecific random factors. The coefficient β_1 captures the difference in dividend yield one year after the changes in stock price informativeness, and the sign of β_1 indicates whether dividend yield increases or decreases following the changes in price informativeness. The sign of the coefficient β_1 is predicted to be negative as the first hypothesis of this chapter (H4) conjectures that dividend yield is negatively associated with the stock price informativeness. Panel A of Table 5.6 represents the results for the change-in-variables model. We find a negative and significant change in dividend yield following changes in stock price informativeness (a coefficient of -0.0002 with t=-2.48). The results for the change-in-variables model lend further support for H5.

Second, we account for the endogeneity issue by adopting a firm fixed-effects model.[95] A firm fixed-effects model is an alternative to the first difference model. Although both models generate unbiased estimators, the fixed-effects model is more efficient as long as any omitted variables are serially uncorrelated (Brockman and Yan 2009). According to Brooks (2008),

[94] According to (Wooldridge 2013: 473), "differencing panel data over time, in order to eliminate a time-constant unobserved effect, is a valuable method for obtaining causal effects".

[95] Roberts and Whited (2012) argue that one of the most common causes of endogeneity in empirical corporate finance is omitted variables, and omitted variables are a problem because of the considerable heterogeneity present in many empirical corporate finance settings. Panel data can sometimes offer a partial solution to this problem.

fixed effect regression is appropriate to control for omitted variables. Furthermore, Jiraporn et al. (2011) suggest that a common method to deal with simultaneity is a fixed-effects regression, which takes into account the unobservable firm-specific characteristics that remain constant through time. The results of the fixed-effects model are reported in Panel B of Table 5.6. The results confirm the results of both our main model as well as the change-in-variables model in Panel A. The stock price informativeness coefficient is negative 0.0010) and significant (t=4.72).

Finally, to further address the issue of the potential endogeneity between stock price informativeness and amount of dividends, we use the Generalized Method of Moments (GMM) system two-step method developed by Arellano and Bover (1995); Blundell and Bond (1998). This method is proper in cases where it is difficult to find instruments to alleviate such a problem (Arellano and Bover 1995; Blundell and Bond 1998; Wintoki et al. 2012; Abdallah et al. 2015). According to Wintoki et al. (2012), given panel data, the dynamic GMM can improve OLS and fixed-effects estimates in three different ways. First, it can include firm fixed effects to address unobservable heterogeneity, which OLS, in particular, does not do. Second, it allows the stock price informativeness to be influenced by previous realizations of, or shocks to, dividends. Third, it may be possible to use some combination of variables from the firm's history as a set of valid instruments to account for simultaneity (assuming that the underlying economic process is dynamic), for instance, if the stock price informativeness is related to past dividends. Thus, an important feature of this method is that it depends on a set of instruments that are contained within the panel itself; previous values of stock price informativeness and dividends can be used as instruments for current realizations of stock price informativeness. This eliminates the need for external instruments.

We estimate our model using the dynamic panel GMM following Wintoki et al. (2012) to address the endogeneity concerns related to unobserved heterogeneity, simultaneity, and reverse causality.[96] This estimator consists of a system of two sets of equations. The first set of equations is expressed in levels and uses the lagged first differences of the dependent variable and the independent variables as instruments. The second set consists of the equations in first differences with the lagged levels of the dependent variable and the independent variables as instruments. For simplicity, it is assumed that the stock price informativeness and control variables are all potentially endogenous. The dynamic GMM method uses lagged levels of the explanatory and dependent values as instruments to control for both dynamic and simultaneous endogeneity; thus, we consider all explanatory variables as endogenous and use their lags of two or more periods as instruments. We consider year and industry dummies as exogenous variables. Moreover, the presence of the lagged dependent variable in the GMM system estimator is also worthy from a dividend dynamics perspective since it allows for the consideration of the partial adjustment of dividend payments in relation to earnings and past dividends which is suggested by Lintner (1956) (see, e.g., Henry 2011) .

The results from the estimation of this model are provided in Panel C of Table 5.6.[97] Stock price informativeness continues to be significantly related to level of dividends (*DY*). The coefficient on Ψ is a significantly negative -0.0012 (t=2.90). To check the consistency of the estimators derived from GMM we validate the assumption that the error terms do not show serial correlation and further validate the instruments. For this purpose we use two specification tests suggested by Arellano and Bover (1995) and Blundell and Bond (1998). The first is to check if the error term is not serially correlated and the second test is the Sargan test of over-identifying restriction. The estimated models all meet these requirements. As can be observed, the AR (1) displays a p-value of 0.000, suggesting that the null hypothesis of no first-order serial correlation is strongly rejected. However, The AR (2) test yields a p-value of 0.809, which means that we cannot reject the null hypothesis of no

[96] A similar model is used to address the issue of potential endogeneity by Henry (2011) between ownership structure and dividend policy and Ben-Nasr and Alshwer (2016) between stock price informativeness and labour investments.
[97] We estimate the GMM model using the xtabond2 command in Stata.

second-order serial correlation. The results in Panel C of Table 5.6 also reveal that the Sargan test has a p-value of 0.106 and as such, we cannot reject the hypothesis that our instruments are valid.

Overall, our finding that firms with high stock price informativeness pay a low level of dividends is robust to accounting for endogeneity concerns related to simultaneity, unobservable heterogeneity, and the reverse causality.

5.5.3. The role of stock liquidity

In this section, we present our results on the impact of stock liquidity on the relationship between firm dividend policy and stock price informativeness. The results are reported in Table 5.7. Column (1) reports the regression results for Equation (5.4) where we add an interaction term between liquidity with stock price informativeness (Ψ). The results show that the effect of price informativeness on dividend yield remains negative and statistically significant even after controlling for the effect of stock liquidity and its interaction with price informativeness. This result lends further support for our earlier finding that high levels of price informativeness are associated with better informed investors and better monitoring and thus less need for dividends. In addition, the coefficients on the liquidity variable (Amihud) is positive and significant, suggesting that firms with illiquid stock pay a higher amount of dividends. This evidence is consistent with Banerjee et al. (2007), Griffin (2010), and Kuo et al. (2013). More importantly is the coefficients on the interaction of price informativeness and the liquidity measure. We find that the negative relationship between dividend payment and price stock informativeness is more pronounced in firms with higher illiquidity ratios (illiquid stocks) (coefficient of Ψ**Liquidity*=-0.0010 with a t-statistic=-3.81). Because *DY* and Ψ are negatively related, this suggests that the effect of price informativeness on *DY* is stronger (weaker) in firms with illiquid (liquid) stocks. In other words, investors in firms with less informative prices are more likely to receive a higher dividend payment when the liquidity of their stocks is low, confirming our H6.

Table 5.6 Dividends and stock price informativeness: endogeneity issue

This table reports the results regarding the effect of stock price informativeness on amount of dividend payment while controlling for endogeneity. Panel A represents the results of the change model and Panel B represents the results of the fixed-effects model. Panel C represents the results of the GMM model. The dependent variable is DY measured by the. $\Psi = ln\,((1 - R^2)/R^2)$, where R^2 is from a regression of the daily stock returns on daily market and industry returns. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets.. Growth is the percentage change in total assets. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively. AR(1) and AR(2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. The Sargan test of over-identification is under the null that all instruments are valid.

Panel A: Change-in-variables Model		Panel B: Fixed-effects Model		Panel C: GMM Model	
$\Delta\Psi$	-0.0002**	Ψ	-0.0010***	Ψ	-0.0012***
	(-2.48)		(-4.72)		(-2.90)
ΔLeverage	-0.0022194**	Leverage	-0.0039***	Leverage	0.0008
	(-2.42)		(-1.76)		(0.31)
ΔProfitability	0.0016***	Profitability	0.0085***	Profitability	0.0050
	(2.98)		(5.54)		(0.96)
ΔGrowth	0.0006477***	Growth	0.0021***	Growth	-0.0437
	(2.76)		(3.96)		(-0.65)
Intercept	0.0008	Intercept	0.0150***	Lagged DY	0.8884***
	(1.54)		(14.55)		(22.32)
Year effects	Yes	Year effects	Yes	Year effects	Yes
Industry effects	Yes	Industry effects	No	Industry effects	Yes
Observations	5995	Observations	6980	Observations	6955
F-statistic	5.41***	F-statistic	7.47***	F-statistic	905.41***
Adj. R-squared	0.0232	Adj. R-squared	0.0660	AR(1) test (p-value)	0.000
				AR(2) test (p-value)	0.809
				Sargan test (p-value)	0.106

We follow another way to test H6 by repeating the estimation of equation (5.1) on two sub-samples of firms with high and low stock liquidity. Two sub-samples are firstly formed based on the median value of illiquidity ratio where the sub-sample with a value of illiquidity ratio above the median value of the full sample is considered as illiquid stocks, and the others are liquid stocks. As H6 conjectures that the relationship between stock price informativeness and the amount of dividend payment is likely to be stronger for illiquid stocks (stocks with high illiquidity ratio), the significance level of coefficient of stock price informativeness for illiquid stocks is predicted to be greater than the significance level of coefficient of stock price informativeness for liquid stocks. The results are reported in Column (2)-(3) of Table 5.7. We split the sample into two groups, one for firms with liquid stocks (Column 2) and the other for firms with illiquid stocks (Column 3) according to the median of the liquidity variable (Amihud). We find a significant negative association between stock price informativeness and dividend yield in firms with a high Amihud ratio (illiquid stocks) but no material relationship is found in firms with a low Amihud ratio (liquid stocks), providing further support for H6. This suggests that firms with illiquid stock are more likely to pay higher dividends in firms with illiquid stocks. Both the split sample design and the interaction term support our second hypothesis that a firm's stock liquidity can affect the dividend–price informativeness relationship.

As a robustness check, we use alternative measures of stock liquidity, namely bid–ask spread (*Spread*) and turnover ratio (*Turnover*). Table 5.8 presents the results where Panel (A) reports the results for Spread and Panel (B) reports the results for Turnover. Consistent with the notion that lower stock liquidity are expected to affect the relationship between dividend and price informativeness, Column (1) of Panel (A) shows a negative and significant relation (coefficient=-0.0012with a t-statistic=-4.89) between *DY* and Ψ**Liquidity*, suggesting that the effect of price informativeness on *DY* is stronger (weaker) in firms with illiquid (liquid) stocks. Using the split sample design confirms our results. Columns (2) and (3) of Panel (A) of Table 5.8 show a significant negative association between stock price informativeness and dividend yield in firms with high bid–ask spread (illiquid stocks) but no material relationship is found in firms with low bid–ask spread (liquid stocks). Column (4) of Panel (B) of Table 5.8 shows a positive and significant relation (coefficient = 0.0.0006 with a t-statistic =2.12) between *DY* and Ψ**Liquidity*. Because *DY* and Ψ are negatively related, this suggests that higher stock liquidity can reduce the effect of stock price informativeness on dividends. Columns (5) and (6) shows that, while there is a significantly negative effect of stock price informativeness on dividend yield for firms in both sub-samples, the effect is more significant in firms with low turnover ratio (illiquid stocks).

Taken together, the results in Tables 5.7 and 5.8 support H6, which suggests that the negative effect of stock price informativeness on dividends is stronger in firms with illiquid stocks. This result is in line with the view that dividends are more important in illiquid stocks that are associated with more trading frictions (Banerjee et al. 2007) and more asymmetric information (Welker 1995; Richardson 2000) than liquid stocks.

Table 5.7 Dividends and stock price informativeness: the role of stock liquidity

The table reports the regression results regarding the role of stock liquidity in the effect of stock price informativeness on amount of dividend payment. Stock liquidity is measured using theAmihud illiquidity ratio. Column (1) presents the results based on the interaction term. Columns (2) and (3) present the models for the two sub-samples of firms with below and above the median of Amihud. The dependent variable is DY measured by the. $\Psi = ln\left((1-R^2)/R^2\right)$, where R^2 is from a regression of the daily stock returns on daily market and industry returns. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is the percentage change in total assets. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	(1)	High Liquidity (Low Amihud) (2)	Low Liquidity (High Amihud) (3)
Ψ	-0.0008***	-0.0015***	-0.0006***
	(-6.31)	(-6.59)	(-5.00)
Liquidity	0.0103**		
	(14.06)		
Ψ *Liquidity	-0.0010***		
	(-3.81)		
Leverage	0.0011	0.0045***	-0.0025**
	(1.14)	(2.90)	(-2.22)
Profitability	0.0215***	0.0350***	0.0150***
	(20.54)	(14.82)	(16.87)
Growth	-0.0041***	-0.0077***	-0.0008
	(-6.05)	(-6.46)	(-1.15)
Intercept	0.0106***	0.0184****	0.0082***
	(10.48)	(11.72)	(9.14)
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Observations	6623	3325	3298
F-statistic	88.28	29.33	41.45
Adj. R-squared	0.2348	0.1469	0.1741

Table 5.8 Robustness check for the role of stock liquidity: alternative liquidity measures

The table reports the regression results regarding the role of stock liquidity in the effect of stock price informativeness on amount of dividend payment using two alternative liquidity measures: bid–ask spread (Spread) and turnover ratio (Turnover). Panel A reports the results for Spread and Panel B reports the results for Turnover. Column (1) and (4) presents the results based on the interaction term. Columns (2)-(3) present the models for the two sub-samples of firms with a bid–ask spread below and above the median, and Columns (5)-(6) present the models for the two sub-samples of firms with a turnover ratio above and below the median. The dependent variable is DY measured by the. $\Psi = ln\,((1-R^2)/R^2)$, where R^2 is from a regression of the daily stock returns on daily market and industry returns. Leverage is the sum of current liabilities and long-term debt over total book assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is the percentage change in total assets. T-statistics are reported in parentheses. Standard errors are heteroscedasticity-consistent. ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

	Panel A: Spread			Panel B: Turnover		
		High Liquidity Low Spread	Low Liquidity (High Spread)		High Liquidity High Turnover	Low Liquidity Low Turnover
	(1)	(2)	(3)	4	(5)	(6)
Ψ	-0.0008***	-0.0018	-0.0005***	-0.0024***	-0.0019**	-0.0023***
	(-5.84)	(-0.87)	(-3.63)	(-12.92)	(-2.02)	(-12.44)
Liquidity	0.0107***			0.0001***		
	(14.04)			(0.12)		
Ψ *Liquidity	-0.0012***			0.0006**		
	(-4.89)			(2.12)		
Leverage	0.0013	0.0049***	-0.0017	0.0034**	(0.0057)***	0.0000
	(1.38)	(3.28)	(-1.50)	(3.42)	4.14	(0.02)
Profitability	0.0210***	0.0401***	0.0149***	0.0251***	0.0244***	0.0256***
	(20.69)	(14.14)	(16.17)	(22.92)	(17.31)	(14.40)
Growth	-0.0040***	-0.0074***	-0.0009	-0.0037***	-0.0051***	-0.0015
	(-6.05)	(-5.93)	(-1.22)	(-5.41)	(-5.98)	(-1.29)
Intercept	0.0107***	0.0184***	0.0078	0.0174***	0.0204***	0.0145***
	(10.80)	(12.60)	(8.46)	(16.21)	(13.16)	(11.41)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6931	3461	3470	6609	3353	3256
F-statistic	100.21***	22.74***	41.65***	69.49***	49.8***	31.32***
Adj. R-squared	0.2252	0.1355	0.1456	0.1912	0.1977	0.1987

5.6. Conclusion

In this chapter, we add a new and essential element to the literature on the determinants of amount of dividend paid, which is stock price informativeness. In the context of signalling theory and agency theory, we develop and test the hypothesis that the amount of information incorporated into stock prices affects the amount of dividend paid by the firm.

We conjecture that if stock prices are informative and investors are already well informed about a firm’s prospectus, managers are less likely to pay high dividends to signal information. In this sense, stock markets are able to perform an informational role normally associated with dividends. Likewise, when prices are informative, it is more likely that informed investors are able to directly intervene and monitor the management team (e.g., via takeovers). For this reason, an informed stock market can also play a role in monitoring managers.

We predict that more informative prices lead to a lower level of dividends. Using a sample of UK firms over the period 1996-2013, we find strong evidence to support this prediction. We show that a higher level of stock price informativeness (measured by firm-specific return variation) is associated with a lower level of dividends. This result is robust to using other models to estimate firm-specific return variation and to controlling for endogeneity issues. We also find that the effect of price informativeness on dividends is only observed in small firms, which is consistent with the argument based on the signalling model. Small firms typically face greater asymmetric information and hence are more likely to use dividends for signalling purposes in order to reduce information asymmetries. Moreover, there is evidence to support the argument based on the agency costs, as the effect of price informativeness on dividends is only seen in low-growth firms and those with low leverage. Low-growth firms and less-levered firms face high agency costs due to more excess cash in the firm, which they should mitigate by paying higher dividends.

We further examine the role of the stock liquidity informativeness–dividend relationship. Our findings show that the negative effect of stock price informativeness on dividends is stronger in firms with illiquid stocks. This in line with the view that firms with illiquid stocks are associated with higher trading frictions and asymmetric information, and hence there is more need for dividends to reduce such problems.

Stock prices informativeness has been documented to be of vital importance to the functional efficiency of the stock markets (Durnev et al. 2003) and to play a significant role in determining different corporate decisions (Chen et al. 2007a; Frésard 2012; Ben-Nasr and Alshwer 2016). Given the significance of stock price informativeness, the findings of this chapter have important implications for firms and investors. This study provides meaningful insights into the role of stock price informativeness in determining the amount of dividends paid by a firm and how the firm’s stock liquidity affects this role.

Chapter 6: Conclusion

6.1. Introduction

This thesis examines the possible links between dividend policy, various aspects of stock liquidity, and price informativeness. In particular, the three empirical issues examined in each empirical chapter of the thesis are as follows. First, Chapter 3 analyzes the effect of dividend payment decisions on various aspects of stock liquidity. Second, Chapter 4 examines the impact of a firm's dividend payment decisions on systematic liquidity risk. Third, Chapter 5 investigates the impact of stock price informativeness on dividend policy and how stock liquidity can influence this relationship.

The remainder of this chapter is organized as follows: Section 6.2 outlines the findings and the contributions of the first empirical chapter, Chapter 3, which examines the relationship between dividend policy decisions and stock liquidity. Section 6.3 summarizes the findings and the contributions of the second empirical chapter, Chapter 4, which examines the effects of dividend policy decisions on systematic liquidity risk. Section 6.4 summarizes the findings and the contributions of the third empirical chapter, Chapter 5, which investigates the relationship between dividend policy and stock price informativeness. Section 6.5 discusses the research implications, limitations, and future research.

6.2. Dividend policy and stock liquidity

Chapter 3 analyzes empirically the impact of dividend policy decisions on stock liquidity. Different aspects of stock liquidity are captured by bid–ask spread, turnover ratios and illiquidity ratio. This chapter makes several contributions.

First, we contribute to the literature linking stock liquidity to different areas of corporate finance (Rubin 2007; Gopalan et al. 2012; Poon et al. 2013; Prommin et al. 2014; Huang et al. 2015; Hillert et al. 2016) by identifying dividend policy as another influential determinant of stock liquidity. Given the few prior studies that examine the liquidity impact of dividend policy and their conflicting results, more empirical studies are warranted. Unlike previous studies that mostly investigate the relationship between dividend policy and stock liquidity by examining the changes in a certain measure of stock liquidity following dividend announcements (Richardson et al. 1986; Mitra and Rashid 1997; Bozos et al. 2011; Dasilas and Leventis 2011), we consider regression analysis. This analysis enables us to test how a firm's dividend policy decisions determine its stock liquidity while controlling for other variables that might affect this relationship. More specifically, we take into account various market- and accounting-based control variables, which the literature has identified as important determinants of stock liquidity. Furthermore, in order to control for possible endogeneity bias due to unobservable heterogeneity, this study includes year and industry dummies in all the model specifications. Additionally, we use lagged independent variables to control for simultaneity. Second, previous studies focus mostly on the effect of dividend policy on a single aspect of stock liquidity, such as the trading costs aspect that is measured by bid–ask spread (Howe and Lin 1992; Mitra and Rashid 1997) or trading activity measured by trading volume (Richardson et al. 1986; Bozos et al. 2011; Dasilas and Leventis 2011). However, stock liquidity reflects several aspects. Kyle (1985) and Lesmond (2005) argue that because liquidity is very difficult to define and even more difficult to estimate, a list of measures is required to capture the different aspects of liquidity. Due to the uncertainties associated with liquidity estimation, we use proportional bid–ask spread, turnover ratio and Amihud's (2002) illiquidity ratio to capture the impact of dividend policy on trading costs, trading quantity and price impact dimensions of liquidity, respectively. Third, our study complements earlier studies of the impact of dividend policy on firm value. Higher stock liquidity that is associated with dividend payments can result in a lower rate of return and higher firm valuation. Finally, to the best of the author's knowledge, this study is the first of its kind that examines the role of dividend policy decisions in determining stock liquidity in the UK. We argue that due to the differences in market structure and liquidity characteristics of the UK market compared to the US market, this study adds further insights to the current literature. It is vital that we research this area given that UK equity markets are the most heavily traded in the world, with the exception of the USA.

The findings of this chapter can be briefly summarized as follows. First, we report significant differences in trading costs and trading activity between dividend payers and non-payers as well as between high-dividend payers and low-dividend payers. For example, we report a negative relationship between dividend policy decisions and both proportional bid–ask spread and price impact ratio. These findings are consistent with the predictions of Bhattacharya (1979) and Miller and Rock (1985), who suggest that dividend payments result in a lower level of information asymmetry, leading to higher stock liquidity. The use of dividends as a monitoring role also provides further support to our findings. Dividend-paying firms are more likely to visit the capital market, leading to more monitoring and hence more information being released to the market (Easterbrook 1984). However, stock turnover ratio is found to be affected negatively by whether or not a firm pays dividends. This result is maybe due to investors' tendency to buy and hold stocks with high dividends (Hotchkiss and Lawrence 2007; IOSCO Emerging Markets Committee December 2007).

To validate the results, we perform a number of robustness tests and model specifications. First, the use of a two-stage regression approach further confirms that our results are not biased due to endogeneity issues. Second, we find that the positive relationship between dividend policy and stock liquidity is supported across time and cross-sectionally through using two panel-data regression methods, fixed effect and between estimator. Finally, we address the possibility that the relationship between dividend policy and stock liquidity is affected by the size of the firm. We find that compared to non-dividend-paying (low-dividend paying) firms, dividend-paying (high-dividend paying) firms are more liquid, especially when they are larger. These findings are again consistent with our main argument based on information asymmetry and agency costs problems since large firms often face lower degrees of asymmetric information and agency costs, which may explain their greater level of stock liquidity.

6.3. Dividend policy and systematic liquidity risk

Chapter 4 examines the impact of firms' dividend payment decisions on systematic liquidity risk. This chapter applies a liquidity-augmented asset pricing model (LCAPM) to examine the impact of dividend payment decisions on the liquidity risk. In this chapter, we hypothesize that a higher (lower) liquidity associated with a firm's decision to pay dividends induces a lower (higher) liquidity risk,. By examining this hypothesis we make several contributions.

First, we contribute to the growing literature on the effects of several corporate finance areas on systematic liquidity risk (e.g., Lin et al. 2009; Ng 2011; Cao and Petrasek 2014; Mazouz et al. 2014) by investigating the impact of dividend policy decisions on the systematic liquidity risk. Second, we contribute to the literature on the valuation effects of dividend policy (Al-Yahyaee et al. 2011; Bozos et al. 2011; Dasilas and Leventis 2011; Liu and Chen 2015). Recent literature in finance suggests that liquidity risk is a non-diversifiable systematic risk that affects stock returns. Many studies find that expected stock returns are positively related to the sensitivities of returns to fluctuations in aggregate liquidity (Pástor and Stambaugh 2003; Acharya and Pedersen 2005; Liu 2006) Liquidity risk is also significant and priced in different markets, suggesting that it is a persistent risk that affects firm value (Lee 2011).To the best of our knowledge, we are the first to introduce systematic liquidity risk as an important factor by which dividend policy can affect firm value.

In a related study, Banerjee et al. (2007) show that systematic liquidity risk declines following dividend initiations. We, however, differ from their study in two ways. First, their empirical analysis focuses on only dividend initiations, i.e., the decision as to whether the firm pays a dividend (and not how much to pay). The empirical research on dividend decisions suggests that firm managers are more likely to face decisions related to the level of dividends than decisions to either introduce dividends for the first time or eliminate existing dividends (Li and Lie 2006). Therefore, we study also the effect of dividend levels. Second, the results of Banerjee et al. (2007) are based on a univariate analysis. However, we argue that the firm's return sensitivity to market liquidity might depend on other factors such as firm-specific variables. Thus, a univariate analysis may not reveal the true effect of dividend policy on systematic liquidity risk. A multivariate analysis is necessary to understand whether, and why, individual firms with different characteristics display varying sensitivity to market liquidity.

Our findings from the analysis of the impact of the firm's dividend policy decisions on the liquidity risk are as follows. First, we document a negative relationship between dividend policy decisions and systematic liquidity risk. Specifically, we find that non-dividend-paying firms exhibit significantly higher systematic liquidity risk than their dividend-paying counterparts. We also find that the systematic liquidity risk of dividend payers is significantly negatively associated with the amount of dividend payments. These findings remain robust after controlling for other determinants of liquidity risk.

Overall, the findings of this chapter are consistent with the arguments of Amihud and Mendelson (1986), Pástor and Stambaugh (2003), and Liu (2006), who suggest that given that liquidity is priced, any increase in liquidity would lead to lower liquidity risk and, hence, lower expected returns. The increase in stock liquidity associated with dividend policy is in line with the asymmetric information theory of Bhattacharya (1979) and Miller and Rock (1985), which suggests that dividend payments are associated with lower asymmetric information and hence higher liquidity. These findings are also consistent with the flight-to-quality phenomenon (Acharya and Pedersen 2005; Brunnermeier and Pedersen 2009) in which adverse liquidity shocks force investors to sell off assets that are associated with higher uncertainty, asymmetric information, and trading costs, leading to a decline in asset prices. Banerjee et al. (2007) argue that during periods of low market liquidity, investors' demand for dividend-paying stocks, and thus the value of such stocks relative to non-paying stocks, is higher.

6.4. Dividend policy, price informativeness, and stock liquidity

Chapter 5 investigates the relationship between stock price informativeness and amount of dividend paid and how stock liquidity can influence this relationship. In doing this, we make several contributions.

First, while previous literature has significantly increased our understanding of the determinants of dividend policy, little attention has been paid to whether and how capital markets affect dividends. By focusing on the role of stock prices on amount of dividend paid, this chapter helps to fill part of this gap by adding stock price informativeness to the list of the determinants of dividend amount. Second, it adds to the growing literature on the informational content of market prices and the real effects of financial markets (e.g., Bond et al. 2012). Some existing studies highlight the existence of an informative feedback going from the stock market to different corporate decisions such as investments (Chen et al. 2007a; Bakke and Whited 2010), cash savings (Frésard 2012), mergers and acquisitions (Luo 2005), and labour investments (Ben-Nasr and Alshwer 2016). This chapter identifies a new channel through which stock prices affect corporate decisions. Specifically, it argues that stock prices contain a variety of valuable information that can help managers in their decision making regarding amount of dividends. We build on the work of De Cesari and Huang-Meier (2015) who focus on how the sensitivity of dividend changes to abnormal returns varies with information in stock prices. Specifically, we study the direct effect of information in stock prices on dividend policy by studying its effects on amount of dividend paid. Based on asymmetric information and agency costs models, we propose that the amount of information incorporated into prices affects firms' choice of dividends as a signalling device and as a monitoring mechanism. This adds a new explanation for use of payout policies for signalling purposes (Bernheim and Wantz 1995; DeAngelo et al. 2000; Grullon et al. 2002; Hail et al. 2014) as well as contributes to the literature on the interaction between dividends and other monitoring mechanisms (Grinstein and Michaely 2005; Grullon and

Michaely 2012; Al-Najjar and Belghitar 2014; Hoberg et al. 2014; Chang et al. 2016). To the best of our knowledge, this study is the first to examine whether the role of dividends as signalling and discipline mechanisms is affected by the level of stock price informativeness. Finally, we argue that stock liquidity may play a role in the impact of stock price informativeness on amount of dividend paid. More specifically, the association between stock price informativeness and amount of dividend paid is likely to be stronger in illiquid firms. Our argument is motivated by the evidence of the greater importance of dividends for firms with illiquid stocks than those with liquid stocks. Firms with illiquid stocks are more likely to pay dividends than those with liquid stocks (Banerjee et al. 2007, Kuo et al. 2013). Moreover, firms with illiquid stocks are associated with a higher level of asymmetric information (Welker 1995; Richardson 2000), and hence the need for dividends to reduce it are more valuable in these firms. Therefore, we further contribute to the literature by examining the effect of stock liquidity on the price informativeness–dividend relationship.

The main findings of this chapter are as follows. First, we report a negative relationship between stock price and amount of dividend paid. This finding is consistent with the view that firm managers pay high dividends with the intension to convey positive signals to the capital markets about firms' potential cash flows and earnings, thereby increasing investors' confidence in respect of firms' future performance. Therefore, firm managers are more likely to maintain a relatively low level of dividends when the stock price informativeness is at a high level. This finding is also consistent with the view that stock prices serve as a disciplinary means. Particularly more informative stock prices lead to a better monitoring of managers (Ferreira et al. 2011), which mitigates the agency-related problems. Consequently, managers are less likely to use dividends as a mechanism to reduce agency costs, leading to a lower dividend payment. We also find that the effect of price informativeness on dividends is only observed in small firms, which is consistent with the argument based on the signalling model. Further, the negative relation price informativeness and dividends is only seen in firms with low growth and those with low leverage ratio, consistent with the argument based on the agency costs. Second, we find that the negative relationship between stock price informativeness and amount of dividend paid is stronger for firms with illiquid stocks, confirming our conjecture that stock price informativeness has a stronger effect on amount of dividend paid in firms when their investors are exposed to more trading frictions and asymmetric information.

To ensure the validity of our results, we carry out a number of robustness checks. First, we find that our results are robust to the use of alternative estimates of firm-specific return variations as measures of stock price informativeness by re-estimating firm-specific return variation using two alternative models: (i) Brockman and Yan's (2009) model and (ii) Fama and French's (1993) three-factor model. Second, the application of several models such as the firm fixed-effects model, change-in-variables approach and dynamic GMM model confirms that our findings are not affected by endogeneity bias resulting from unobserved heterogeneity, simultaneity, and reverse causality.

6.5. Research implications, limitations, and future research

The empirical findings of this thesis should be of particular interest to academics, investors, and company managers. From an academic perspective, we study areas that were recently highly researched. First, the results provide new insights in the area which cover the implications of corporate finance on stock liquidity. Second, we shed some light on the importance of the stock price informativeness in determining dividends. We show that stock price informativeness is amongst the important determinants of the amount of dividends. Moreover, these results should be beneficial to researchers in understanding dividend differences among firms, even in the same industry. That is, the level of stock price informativeness may propose a further explanation for these differences.

Furthermore, the evidence presented in Chapters 3 and 4 should be of considerable importance to both companies and investors. From a firm's perspective, stock liquidity and systematic liquidity risk have a direct effect on transaction costs and the perceived risk of the stock, which, consequently, have an effect on the firm's CEC. The results suggest that when companies pay dividends, this results in a significant increase in stock liquidity and a reduction in stock return sensitivity. From the investors' perspective, these findings would help them in the formation of their investment strategies, to match their trading with those firms where stock liquidity is expected to be high. The findings would also help them to realize higher gains by avoiding high transaction costs, which may result when the market becomes illiquid in adverse conditions. In addition, the findings of Chapter 5 show that stock price informativeness has significantly negative effects on dividend payments. This would help firms to gain a further insight into choosing their dividend policies. Specifically, to the extent that stock prices incorporate more information about the firm fundamentals, the need for dividends as a signalling mechanism becomes less. Additionally, firms with higher stock price informativeness are more subject to the scrutiny and monitoring of the capital markets, hence they have less need to use dividends as a discipline mechanism.

On the limitations side of our study, we may point out the following limitations. First, the study is limited to a sample of non-financial and non-utilities firms. Financial and utilities firms are excluded because they follow different financial policies and are governed by different regulations. Therefore, it may also be worth conducting further research by focusing on financial and utilities firms in order to provide a more comprehensive picture of dividend policy behaviour and implications of all firms. Second, dividend policy literature mostly focuses on studying cash dividend payments behaviour of firms, because cash dividends are the most common form to distribute profits to shareholders. We also limit our analysis to cash dividend payments. Dividend policy, however, involves other types of payouts, such as stock dividends or share repurchases. Further research, therefore, could be conducted on whether different payout mechanisms such as stock dividends and repurchase have different effects on systematic liquidity risk and how they are affected by stock price informativeness. Third, stock liquidity is a broad concept and difficult to be captured by a single measure.

Given that the literature on stock liquidity suggests an enormous number of liquidity measures, we limit our study to the most commonly used measures such as bid–ask spread, turnover ratio, and Amihud's illiquidity ratio. Furthermore, given that our measure of systematic liquidity risk is estimated from a regression model, one can argue that systematic risk is not observed and hence the results may be affected by the error in variable problem. However, it is common for regressions to be run in which observations on the dependent variable are estimated in another analysis (Lewis and Linzer 2005). Therefore, we use liquidity beta as a measure for liquidity risk using a similar procedure applied widely by previous studies (e.g., Cao et al. 2014; Ng 2011). Also, in this study and following most of the previous theoretical and empirical literature (Durnev et al. 2004; Jin and Myers 2006; Ferreira and Laux 2007; Frésard 2012), we measure stock price informativeness by firm-specific return variations. Although the literature has proposed different justifications for using firm-specific return variation as a proxy for stock price informativeness, this measure has been a subject for some debate. For example, Dasgupta et al. (2010) suggest that the relation between stock price informativeness and firm-specific return variation is unclear. However, to alleviate this concern, robustness tests are carried out by using alternative measures of firm-specific return variations estimating using different models. However, the measure of stock price informativeness is acknowledged as one of the major limitations of this study.

Our results also open the doors to at least four interesting issues for future research. First, while the present thesis highlights the role of information included in stock prices for the dividend determination, future research can be conducted to understand of the importance of stock price informativeness in determining other corporate decisions by examining whether it affects other corporate decisions, such as corporate advertising and innovation. Future research could also examine how dividend policy affects changes in stock liquidity in response to changes in market liquidity, as opposed to stock returns in response to changes in market liquidity as studied in this thesis. Third, one possible direction of future research is to re-examine the interrelations between dividends, stock liquidity, and stock price informativeness in markets other than the UK. This may also be a valuable area for research given that dividend policies and financial markets in different countries may have different characteristics and may be subject to different regulations. Finally, although this study has totally relied on secondary data to investigate the research questions, further research using primary data, such as questionnaire surveys and interviews conducted with firm management and market investors, may enhance the current findings and therefore would be useful in understanding their perceptions about interaction of dividend policy, stock liquidity, and stock price informativeness.

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Appendices

Appendix A

Pooled data regression with year and industry dummies

As stated in the main body of the thesis, the relationships between a firm's dividend policy and stock liquidity, liquidity risk and price informativeness can be driven by many factors, some of which may not be observable. Omitted variables refer to those variables that are not in a model or an analysis that influences both the cause and effect and so may cause bias (Shadish et al., 2002). In order to control for unobserved heterogeneity, we use pooled data and control for fixed effects using time and industry dummies. Dummy variables are variables that take on the value 0 or 1 to indicate the absence or presence of some categorical effect that may be expected to shift the outcome (Wooldridge 2010). Due to the time series dimension, a different time intercept is allowed. Using time dummy variables can allow the intercept to differ across periods. Moreover, industry dummies are included to control for industry-specific factors.

Pooled data

The models that are employed in this thesis are tested using pooled data analysis which contains pooling of time series and cross-sectional observations (combination of time series and cross-section data) (Gujarati 2004). The pooled data analysis is employed because of its several advantages. Pooling data produces more informative data, more variability, less collinearity among variables, more degrees of freedom, and more efficiency. Furthermore, pooling data of many observations minimises the bias that might result if we aggregate individuals or firms into broad aggregates (Gujarati 2004). The pooled data analysis has the capability to capture the effect of time-varying factors on response variables and can be estimated using Ordinary Least Square (OLS) method. The OLS method of estimation is very popular and common in linking cause and effect in a regression model. However, in order for the OLS to be the best choice in the estimation, the errors in the model are assumed to have the same variance (i.e., homoscedasticity) and also be independent from each other. However, (Gujarati 2004) contends that these assumptions are highly restricted. Hicks (1994) states that OLS assumptions may be violated due to following reasons. First, errors might be serially correlated, i.e., they are not independent from one period to another and hence the errors from pooled regressions are considered autocorrelated. Second, errors tend to have different variances across units and hence considered heteroscedastic. Third, errors might be non-random across spatial and/or temporal units since parameters are heterogonous across subsets of units. Therefore, despite the simplicity and the advantages of using the pooled model, pooled OLS can be inconsistent if we have unobserved individual-specific effects that cause the error term to correlate over time for a given individual.

Fixed-Effect vs. Random-Effect

The fixed and random effects models relax the assumption that the intercept coefficients are constant across firms. The fixed-effect model is used to estimate the effect of predictors on the dependent variables by controlling for the constant variations arising from the omitted variables and for unobserved heterogeneity between groups over time. The assumption of this model is that the individual-specific effect is related to the regressors. The fixed-effect approach works by removing much of the error variance that arises due to the misrepresentations resulting from the individual differences between groups that come from the omitted variables or the unobserved heterogeneity that is correlated with the regressors. Nevertheless, this model permits for correlations between the unobserved individual effects with the model’s variables (Greene 2008). That is, problems of autocorrelation or heteroscedasticity that affect estimation arise from time or group-specific variations and cannot be handled using the fixed- effect model. However, random-effect models assume no individual or fixed effects, and thus consider the individual-specific constant terms as being randomly distributed within or between the cross-sectional groups (Greene 2003).

To determine which model – pooling, fixed effects, or random effects is most appropriate, we need some statistical tests. First of all, to test whether the panel data support the fixed effects model we can conduct F-test which is computed from the loss of goodness-of-fit between the pooled OLS model and the fixed effects model (Baltagi 2005). This test tests for the null hypothesis that there are no firm-specific effects. If the null hypothesis is rejected, it means that the fixed effects model is favourable over the pooled OLS model. We perform this test and the statistic is highly significant, suggesting that there are firm-specific effects. The second stage is to choose between the fixed effects model and random effects model and therefore we use the Hausman specification test (Hausman 1978). The null hypothesis states that the individual-specific effects are uncorrelated with the explanatory variables. If the null hypothesis is rejected, i.e. the individual specific effects are correlated with explanatory variables then the fixed effects model is consistent and efficient but the random effects model is inconsistent (Greene 2003). However, if we fail to reject the null hypothesis i.e. if the individual specific effects are uncorrelated with the explanatory variables, then the random effects model is consistent and efficient, the fixed effects estimator is consistent, but not efficient. The chi-square statistic from the Hausman test is highly significant in all our models, suggesting a firm fixed effect model is preferred to a random effects model.

Appendix B Dividend paying firms only: descriptive statistics and correlation matrix

Panel A reports descriptive statistics of yearly observations of the main variables of the study. Panel B reports the correlation coefficients among the dependent and independent variables. Spread denotes the proportional quoted bid-ask spread, Turnover is the turnover ratio, Amihud is the Amihud's (2002) illiquidity ratio, all of these variables are calculated as the averages of daily values over a particular year. Size is the firm size, Growth is the growth opportunities. Profitability is the firm profitability. Return is the average of daily returns over a year. Volatility is the standard deviation of daily returns over a year. DPS is the dividend per share. HighDPS is a dummy variable which equals 1 for observations with above the median DPS and 0 otherwise. See Table 3.2 for variables measurement. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

Panel A: Descriptive Statistics

	DPS	HighDPS	Turnover	Spread	Amihud	Size	Growth	Profitability	Return	Volatility
Observations	6596	6596	6596	6596	6596	6596	6596	6596	6596	6596
Mean	0.1224	0.5028	0.003	0.021	0.001	12.9141	0.075	0.102	0.000	0.0190
Median	0.072	1	0.003	0.016	0.000	12.7323	0.060	0.096	0.000	0.0177
SD	0.1657	0.5000	0.003	0.021	0.002	1.7487	0.193	0.091	0.002	0.0159
Min	0.003	0	0.000	0.001	0.000	7.4899	-0.602	-0.214	-0.008	0.0000
Max	1.075	1	0.016	0.104	0.012	19.2410	0.674	0.391	0.005	0.0850

Panel B: Correlation Matrix

	DPS	HighDPS	Turnover	Spread	Amihud	Size	Growth	Profitability	Return	Volatility
DPS	1									
HighDPS	0.5245***	1								
Turnover	0.0972***	0.1237***	1							
Spread	-0.2572***	-0.3468***	-0.3186***	1						
Amihud	-0.1644***	-0.2214***	-0.2421***	0.5807***	1					
Size	0.3775***	0.3741***	0.3735***	-0.6272***	-0.3635***	1				
Growth	-0.0086	(-0.0278)**	-0.0622***	-0.0958***	-0.1265***	(-0.0213)*	1			
Profitability	0.1295***	0.1605*	-0.0429***	-0.2133***	-0.1861***	-0.0792***	0.2481***	1		
Return	0.0036	0.0200	(-0.0306)**	-0.0636***	-0.0717***	0.028**	0.0132	0.0478***	1	
Volatility	(-0.0244)**	-0.0554***	0.0563***	0.0670***	0.0584***	-0.0360***	0.0272**	(-0.0216)*	-0.3084***	1

Appendix C

Appendix C.1: Descriptive statistics and Correlation matrix of variables used in LCAPM

LIQAmihud, LIQspread, LIQturnover are mimicking liquidity factors. We construct these mimicking liquidity factors in a way similar to Liu (2006). At the beginning of each month from January and July 1996 to July 2013, all FTSE ALL SHARES ordinary common stocks are sorted in ascending order based on their liquidity measures resulting in two independent portfolios, low-liquidity portfolio (LL) consists of contains the 35% lowest-liquidity FTSE ALL SHARES stocks and high-liquidity (HL) consists of the 35% highest-liquidity FTSE ALL SHARES stocks. These two portfolios are held for six months after the formation of portfolio. According to Liu (2006), this six-month holding period is selected because it gives a moderate liquidity premium compared with the 1- and 12-month holding period which looks plausible for estimating the liquidity factor. Then, the liquidity factors are constructed as the monthly profits from buying one dollar of equally weighted (LL) and selling one dollar of equally weighted (HL). r_f is the risk-free rate in month t, r_m is the market return in month t and they are obtained from DataStream.

Panel A: Descriptive Statistics

	$r_m - r_f$	LIQAmihud	LIQspread	LIQturnover	r_f
Mean	0.0017	0.0002	0.0021	0.0030	0.0026
Median	0.0085	0.0008	0.0002	0.0021	0.0033
Min	-0.1367	-0.0861	-0.1150	-0.0885	0.0002
Max	0.0989	0.1012	0.0875	0.0668	0.0054

Panel B: Correlation Matrix

	$r_m - r_f$	LIQAmihud	LIQspread	LIQturnover	r_f
$r_m - r_f$	1				
LIQAmihud	-0.0495	1			
LIQspread	0.0869	0.8493***	1		
LIQturnover	-0.4401***	0.3987***	0.0767	1	
r_f	-0.1950**	0.0390	-0.0554	0.1026	1

Appendix C.2: Descriptive Statistics of Dividend-paying Stocks Sample

This table reports summary statistics of the variables under consideration for a sample of dividend-paying stocks. At each December between 2000 and 2013, the liquidity beta for each stock is computed. The liquidity beta is estimated as the slope coefficient on LIQ while controlling for market returns. The regressions are estimated using the past five years of monthly data (with a minimum of 36 months). Liquidity is measured by the Amihud illiquidity ratio (Amihud), bid-ask spread (Spread) and turnover ratio (Turnover). DPS is the amount of dividend paid per share. HighDPS is a dummy variable that takes the value of 1 for high-dividend-payers, and 0 otherwise. Leverage is the sum of current liabilities and long-term debt over total book assets. The return is based on daily stock returns. The volatility is the standard deviations of daily returns. Book-to-market ratio is defined as the book value of total shareholder equity divided by the market value of equity. Profitability is the ratio of earnings before interest and taxes to total assets. Firm size is the market capitalisation in millions of Pounds.

	Mean	SD	Median	Min	Max
Liquidity beta (Amihud)	0.589	0.830	0.439	-0.995	3.338
Liquidity beta (Spread)	0.602	0.853	0.427	-0.894	3.474
Liquidity beta (Turnover)	0.673	0.737	0.447	0.000	3.901
Amihud	0.001	0.002	0.000	0.000	0.012
Spread	0.021	0.022	0.015	0.000	0.109
Turnover	0.004	0.003	0.003	0.000	0.016
DPS	0.131	0.173	0.078	0.004	1.106
HighDPS	0.496	0.500	0.000	0.000	1.000
Leverage	0.199	0.158	0.185	0.000	0.672
Return	-0.001%	0.179%	0.000%	-0.761%	0.407%
Volatility	1.822%	1.535%	1.739%	0.000%	7.887%
Book-to-Market	0.606	0.487	0.485	-0.172	2.564
Profitability	0.094	0.088	0.089	-0.228	0.359
Firm size (£ millions)	3.268	11.800	0.277	0.008	87.300

Appendix C.3: Differences in Other Characteristics

This table reports the differences in firm characteristics between (1) dividend payers and non-dividend payers and (2) high-dividend payers and low-dividend payers. Liquidity is measured by the Amihud illiquidity ratio (Amihud), bid-ask spread (Spread) and turnover ratio (Turnover). Leverage is the sum of current liabilities and long-term debt over total book assets. The return is the average on daily stock returns. The volatility is the standard deviations of daily returns. Book-to-market ratio is defined as the book value of total shareholder equity divided by the market value of equity. Profitability is the ratio of earnings before interest and taxes to total assets. Firm size is the market capitalisation in millions of Pounds.

	(1)			(2)		
	Dividend payers	Dividends nonpayers	t-statistics (Mann Whitney)	High dividend payers	Low dividend payers	t-statistics (Mann Whitney)
Leverage	0.1999	0.1909	-1.687*	0.2148	0.1835	-7.291***
	(0.1845)	(0.1302)	(-7.685***)	(0.2041)	(0.1633)	(-8.795***)
Amihud	0.0009	0.0052	16.409***	0.0003	0.0012	16.999***
	(0.0000)	(0.0005)	(27.312***)	(0.0000)	(0.0002)	(27.957***)
Spread	0.0212	0.0523	28.7017***	0.0138	0.0280	25.115***
	(0.0153)	(0.0408)	(31.24***)	(0.0069)	(0.0233)	(28.319***)
Turnover	0.0036	0.0038	1.414	0.0039	0.0033	-7.568***
	(0.0028)	(0.0027)	(-0.678)	(0.0030)	(0.0025)	(-7.635***)
Profitability	0.0919	-0.0874	-31.437***	0.1123	0.0768	-15.077***
	(0.0892)	(-0.0164)	(-39.423***)	(0.1027)	(0.0753)	(-15.516***)
Volatility	1.832%	2.411%	10.428***	1.761%	1.882%	2.7975***
	(1.739%)	(2.174%)	(9.754***)	(1.692%)	(1.802%)	(2.670***)
Return	-0.002%	-0.044%	-6.681***	0.007%	-0.009%	-3.107***
	(0.000%)	(0.000%)	(-6.388***)	(0.000%)	(0.000%)	(-2.803***)
Market Beta	0.8675	1.0467	8.304***	0.8449	0.8869	2.3858**
	(0.8099)	(0.9657)	(6.404***)	(0.7983)	(0.8289)	(1.763*)
Firm size (£ millions)	3.0977	0.5448	-14.165***	5.2323	1.2998	-11.007***
	(0.2769)	(0.0873)	(-20.597***)	(0.5510)	(0.1596)	(-20.111***)
Book-to-Market	0.6099	0.8008	8.284***	0.5040	0.7075	15.603***
	(0.4854)	(0.5747)	(6.471***)	(0.4237)	(0.5650)	(13.710***)